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The American STATISTICIAN

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The news publication of the American Statistical Association

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Anyone wishing to change their mailing address should allow eight weeks' notice. A copy of the address taken from an issue of the periodical should accompany the change-of-address request.

ANNUAL MEETING NOTES

EMPLOYMENT REGISTER

An Employment Register will be maintained by The American Statistical Association at its December 1952 Annual Convention in Chicago.

Both employers in search of personnel and members who are seeking new positions should make their needs known by writing in advance of the Annual Meeting to the Employment Register Chairman:

MISS ESTHER ESPENSHADE
160 N. La Salle Street
Room 1440
Chicago 1, Illinois

Mark Your Calendar Now

for

American Statistical Association's Annual Convention

DECEMBER • 1952

SUN	MON	TUE	WED	THU	FRI	SAT
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Palmer House — Chicago

NEWS

Operations Research Society — Fellowships and grants — Positions available — New publications

Operations Research

The first regular meeting of the Operations Research Society, which was formed by a group of leading scientists in May, 1952, will be held at the National Bureau of Standards in Washington, D. C., on November 17th and 18th.

The Society, whose purpose is to promote the application of scientific methods to business and military problems, will hear and discuss papers involving industrial applications of Operations Research; waiting lines; inventories and the use of probability techniques in industry; and the newly-developed Monte Carlo method for handling problems which cannot be solved with ordinary equations. There will also be a research panel on the solution of new problems and the development of new methods which have arisen in industry in the last year.

Professor Philip Morse, of the Massachusetts Institute of Technology, is President of the Society; the membership includes experts from such diverse disciplines as physics, chemistry, biology, mathematics, economics, statistics, etc.

Non-members are invited to attend the meeting and to register at the official headquarters at the Wardman Park Hotel, Washington, D. C.

Further information about the meeting may be obtained from the Secretary of the Society, Mr. John B. Lathrop, 30 Memorial Drive, Cambridge, Mass.

Government Statistics in Paraguay

Paraguay is making an effort to improve the collection, analysis and publication of its economic statistics. A committee on economic statistics, set up by governmental decree in October, 1951, and composed of representatives of various governmental agencies, is charged with studying the statistics and making recommendations for their improvement.

Social Science Research Council Announces Fellowships and Grants for 1953

The Social Science Research Council has announced that the closing date of applications for SSRC Fellowships and grants for 1953 will be Monday, January 5, 1953. Research Training Fellowships designed to further the training of research workers in social science provide full maintenance. Travel grants for area research, grants in aid of research and faculty research fellowships are available to aid scholars of established competence in the execution of their own research. These awards do not provide full maintenance and are not available to students working for degrees. No funds are available for subsidizing the publication of books or articles. All awards are restricted to permanent residents of the United States or Canada and faculty research fellowships are offered only in the United States.

Full details concerning application forms may be obtained from:

Social Science Research Council
726 Jackson Place, N.W.
Washington 6, D. C.

Statistical Advisor Wanted in Formosa

The Mutual Security Agency has an opening for a Statistical Adviser in Formosa at a salary of $8,481 per annum, plus a differential (presently 25%) plus a maximum of $3,200 for quarters. The position involves first an analysis of sources and presentation of a large volume of statistical information now being supplied to the Mission, to indicate the extent to which it may be relied upon in arriving at policy conclusions. Second, the position requires qualified technical assistance to organize and present statistical data for operating control purposes. In addition, technical advice will be given to the Chinese Government agencies.

Send applications to

Mr. R. L. Lamkin
Personnel Division
Mutual Security Agency
Washington 15, D. C.

Educational Testing Service Fellowships

The Educational Testing Service is offering for 1953-54 its sixth series of research fellowships in psychometrics leading to the Ph.D. degree at Princeton University. Open to men who are acceptable to the Graduate School of the University, the two fellowships each carry a stipend of $2,500 a year and are normally renewable.

Fellows will be engaged in part-time research in the general area of psychological measurement at the offices of the Educational Testing Service and will, in addition, carry a normal program of studies in the Graduate School. Competence in mathematics and psychology is a prerequisite for obtaining these fellowships. The closing date for completing applications is January 16, 1953. Information and application blanks will be available about November 1 and may be obtained from: Director of Psychometric Fellowship Program, Educational Testing Service, 20 Nassau Street, Princeton, New Jersey.

Awards Under the Fulbright Act, 1953-54

Applications for grants for university lecturing and post-doctoral level research in the countries listed below may be addressed to the Conference Board of Associated Research Councils Committee on International Exchange of Persons, 2101 Constitution Avenue, Washington 25, D. C.

Austria
Belgium and Luxembourg
Denmark
Egypt
France
Greece
Iraq
Italy
Japan
Netherlands
Norway
Pakistan
Turkey
Union of South Africa
United Kingdom and Colonial Dependencies

UNESCO Handbook of Educational Organization and Statistics

The United Nations Education, Scientific and Cultural Organization (UNESCO) has published the first edition (1951) of its "World Handbook of Educational Organization and Statistics," presenting statistical data on schools, enrollment, teaching staffs, educational expenditures, and other aspects of the educational systems of about 60 different countries. The introduction to the volume reviews previous international efforts to compile statistics in the field, discuss the need for and availability of such data, and indicates some of the problems of terminology and lack of comparability.

The Handbook is arranged alphabetically by country, with a separate section for each country. No summary tables are presented containing comparable figures for different countries, as the lack of agreement among countries on definitions and concepts has so far precluded the possibility of assembling data suitable for such tables.

The descriptive material contained in the Handbook includes diagrams showing the organization of the school system and information on the legal basis, administration and organization of the system, provisions for adult education, health services, school buildings, finance, private schools, and education and status of teachers. A brief glossary of terminology used in the Handbook is appended.

The Handbook is available in English or French editions at $9.00 per copy from the International Documents Service, Columbia University Press, New York 27, N. Y.

New Publications

The Manpower Division of the International Labour Office has brought out Vol. I, No. 1, of a new publication called MIGRATION. It is scheduled to appear every two months in English, French and Spanish and will deal primarily with information on migration possibilities including land settlement, the number and types of workers potentially available for emigration, international activity and technical procedure in the field of migration, national laws and administrative practices related to migration. Contributions to MIGRATION are welcomed. They should discuss technical problems, solutions adopted or proposed operational activity and general policy in the field of migration. Inquiries should be directed to the Manpower Division of the International Labour Office, Geneva, Switzerland.

The Association of Collegiate Schools of Nursing has announced Vol. I, No. 1, of a periodical NURSING RESEARCH. The first issue appeared in June 1952. The periodical will carry articles concerning research in the field of nursing, including articles on methods of research, research projects under way, the research programs of national nursing organizations, etc.

Selective Service Qualification Test

Educational Testing Service has made available a limited number of its summary of statistics on "Selective Service College Qualification Test." The summary covers the tests administered during the spring and summer of 1951. A detailed description of the nature of the scores used in reporting test results is given and a group of appendices give information concerning the technical statistical activities in connection with the testing program. Further information concerning the report may be obtained from the Director of Statistical Aanlysis, Educational Testing Service, 20 Nassau Street, Princeton, New Jersey.

BLS Report on the Older Worker

The Bureau of Labor Statistics has recently issued a report on "Employment and Economic Status of Older Men and Women." The report deals with questions arising from the effects of employment and economic trends on the older age groups in the population. Data from a wide variety of sources have been selected to provide background information for persons particularly concerned with economic and employment problems of an aging population.

The 64-page report, including 27 tables and 6 charts, provides comprehensive information on population and labor force trends, work-life expectancy, income and sources of income, retirement and pension programs, and the job experience of older workers. Data have been presented separately for men and women, wherever possible. The report includes a list of all recent publications of the Department of Labor pertinent to the employment and economic status of older men and women.

The publication, issued as BLS Bulletin No. 1092, is available through the Superintendent of Documents, Government Printing Office, at 30 cents a copy.

HELEN H. RINGE
Division of Manpower and Employment Statistics,
Bureau of Labor Statistics, Department of Labor

Measurement of Manufacturing Productivity Trends

Because of the increasing interest of government officials, labor, management, and the general public in the subject of productivity, the Bureau of Labor Statistics is broadening the scope of its studies in the field to include the analysis and measurement of productivity trends in broad segments of the economy. The new program involves development of a measure for manufacturing activity, and represents some change in emphasis in the BLS program. In recent years, the BLS productivity program has dealt largely with trends in productivity for individual industries or products. The new work involves picking up the type of research which was discontinued during World War II.

The two principal approaches to be used in the development of measures of productivity in manufacturing are those which are related to gross national product and those which utilize data derived from the physical output of goods and services, and the man-hours required in their production. To obtain production and man-hour data the BLS, in its General Productivity Measurement program, utilizes statistics from other sources, including the Bureau of the Census, Bureau of Mines, Department of Agriculture, its own Divisions and others.

In view of the importance of manufacturing and the desire on the part of all interested organizations to know how productivity in manufacturing is changing, BLS plans to develop new series and to adapt the current series on individual manufacturing industries for consolidation into an index representative of manufacturing. Initially, the preliminary manufacturing productivity index may cover only the five years, 1947 through 1951, with an extension backward to 1939, but not necessarily including all the intervening years. Concurrently with this work, BLS will also draw on the background, experience and data of the Department of Commerce in developing procedures for constructing manufacturing and other series derived in part from gross national product estimates.

The findings will ultimately be incorporated in appropriate general releases or articles, or will be included in reports on productivity trends for specific industries as they are issued by BLS. The Bureau will continue to release the indexes prepared under its general productivity measurements and direct reports programs.

ALLAN D. SEARLE
Division of Productivity and Technological Developments, Bureau of Labor Statistics, Department of Labor

BLS Employment Estimates by Size Class of Establishment

At the request of the Defense Production Administration and the National Production Authority, the Bureau of Labor Statistics has developed an employment series by size class of establishment for selected metalworking industries. Relative employment changes among small and large business are of great interest and economic significance in peacetime and even more vital during periods of national emergency, when employment changes are carefully watched as indicators of needed industrial expansion.

The new series are issued in a quarterly release entitled "Employment in Selected Metalworking Industries, by Size Class of Establishment." They present estimates, beginning with July 1951, of total employment and of the number of production workers for the first month of each quarter. Estimates are made for the following industry groups: fabricated metal products; machinery (except electrical); electrical machinery; equipment and supplies; and transportation equipment. Data are also published for the Standard Industrial Classification 3-digit industries included in these industry groups. For each series, estimates are prepared for four size classes: 0-99, 100-249, 250-499, and 500 and over.

Copies of "Employment in Selected Metalworking Industries, by Size Class of Establishment," with information on the sampling and estimating techniques used, may be obtained from the Division of Manpower and Employment Statistics, Bureau of Labor Statistics, Washington 25, D. C.

WALT SIMMONS
Division of Manpower and Employment Statistics,
Bureau of Labor Statistics, Deportment of Labor

"Statistical Services of the United States Government"

A revised and enlarged edition of *Statistical Services of the United States Government* has been issued by the Office of Statistical Standards, Bureau of the Budget. This document provides a general description of the economic and social statistical programs of the United States Government—where they are located, how the data are collected, and what data are available in these areas from Federal agencies.

Part I describes the organization of statistical services within the Federal Government, and the organization and operating methods of the Office of Statistical Standards. It also contains brief descriptions of general principles and practices followed in Federal statistical activities, including such topics as technical aids, use of sampling, relations of Federal and State statistics, and Government use of private statistics.

Part II describes the principal economic and social statistical series. Among the series described are those dealing with demography and health, social insurance and related programs, employment and labor, education, public assistance, criminal and judicial statistics, production, distribution and service trades, prices, finance, construction, housing, foreign trade and shipping, balance of international payments, consumer income and expenditures, and national income and product.

Additional detail is presented in the appendixes, which present a summary of statistical responsibilities of Federal agencies and an annotated bibliography of the principal periodical statistical publications issued by Government agencies.

The earlier edition of *Statistical Services of the United States Government* was prepared for use in the International Statistical Conferences, held in Washington in 1947. Copies were used in training courses by a number of business institutions, in college courses, and as reference material in libraries. The text was translated and published in a number of foreign languages, including French, Portuguese, and Japanese.

Copies of *Statistical Services of the United States Government* may be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., at 45 cents a copy.

1950 Test of Birth Registration Completeness

The second nationwide test of birth registration completeness in the United States was concluded during the past year. Results of the test indicate that certificates were filed by attendants and hospitals for almost 98 percent of the births that occurred during the first three months of 1950. The first test was carried out ten years earlier and showed that 92.5 percent of the births were being registered at that time. The increase in registration completeness is accounted for by a trend toward use of hospital facilities for obstetrical care, greater realization of the value of the birth record, and activities by State registrars to improve registration practices. Birth registration has improved since 1940 in every State. The number of States in which at least 99 percent of the infants were registered increased from 3 in 1940 to 23 and the District of Columbia in 1950.

The project was a cooperative effort of the Bureau of the Census (Population and Housing Division), State and territorial offices of vital statistics, and the Public Health Service (National Office of Vital Statistics). Two sets of independently collected records for infants born January-March 1950 were compared to obtain measures of registration completeness; i.e., birth records on file were matched against 780,000 infant cards filled out by Census enumerators during the 1950 Decennial Census of Population and Housing, for enumerated children born during this 3-month period. Because of the confidentiality of the Census records, people working with them in the Federal, State, and territorial offices were officially appointed special agents of the Bureau of the Census.

The matching operation consisted of 3 major phases: (1) Matching at the National Office of Vital Statistics, utilizing punched cards containing alphabetical and statistical data from each birth record and infant card in the test; (2) a mail survey of parents and guardians designed to verify and correct information on infant cards not matched in the first phase; and (3) searches in State offices of vital statistics for birth records corresponding to the infant cards that remained unmatched following the mail survey.

Results of the birth registration test are helping registrars to localize the few remaining problem areas for promotional activities and establish why attendants fail to register births. They are also being used to adjust tabulated birth data for under-registration. Records in the project are providing the Bureau of the Census with information to investigate the variation of infant enumeration completeness among social and economic groups and the reasons for failure to enumerate infants.

A report of the preliminary results of the test appeared in *Public Health Reports,* Vol. 67, No. 6, June 1952 ("Birth Registration Completeness, United States, 1950" by S. Shapiro and J. Schachter). Another article, "Background and Methods Used in the 1950 Birth Registration Test, United States" by the same authors, is being published in the December 1952 issue of *Estadistica.*

S. Shapiro
Chief, Natality Analysis Branch, National Office of Vital Statistics, Public Health Service, Federal Security Agency

Study of Response Rates to Federal Surveys

The Office of Statistical Standards, Bureau of the Budget, has initiated a study of the response rates attained in surveys conducted by or for Federal agencies. Plans for the study have been developed in consultation with several of the major statistics-collecting agencies, including the Bureau of Agricultural Economics, the Bureau of the Census, the Bureau of Labor Statistics, and the Federal Trade Commission.

Information on response rates for a limited number of selected surveys has already been collected by several agencies, partly as a preliminary to this study and partly for use by the Advisory Committee on Statistical Policy of the American Statistical Association. During July requests were sent to BAE, Census, BLS and FTC for information on additional surveys, with a proposal for sharing research results, progress reports and project plans in the broad field of response. Inquiries have been confined to selected surveys representing different populations of respondents, collection methods, length, subject-matter, and agencies. The information obtained may be useful in developing theories of response behavior which may ultimately be subjected to empirical test.

The study initiated at this time is regarded as the first stage in a continuing program of response research. Ultimately, it is hoped to improve techniques for obtaining response, to attain a better understanding of response phenomena, to learn how quality of responses is affected by techniques which improve the extent of response, and to develop the implications for economical survey design of these evolving ideas about response.

Boyd Ladd
Office of Statistical Standards, Bureau of the Budget

BLS Community Wage Survey Bulletins

Bulletin reports have been issued for the 40 community wage studies conducted by the Bureau of Labor Statistics in late 1951 and early 1952. Occupations common to a variety of industries were studied on a community-wide basis in the program. The bulletins provide all-industry averages and distributions of workers by earnings classes for the following occupations: (a) office; (b) professional and technical; (c) maintenance and power plant, and (d) custodial, warehousing, and shipping. Wherever possible, separate data are given for the 6 major industry divisions studied: manufacturing, public utilities, wholesale trade, retail trade, finance, and services. Work schedules, shift operations and differentials, paid vacations and sick leave plans, insurance and pension plans, and other supplementary wage practices are summarized in the report for each area.

Copies of the reports, entitled "Occupational Wage Survey—(name of area)" are available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. The metropolitan areas for which reports are now available, with the BLS Bulletin Number and price for each, are:

Area	*Bul. No.*	*Price*
Albany-Schenectady-Troy	1108	15¢
Allentown-Bethlehem-Easton	1111	15¢
Atlanta	1102	15¢
Birmingham	1107	15¢
Boston	1106	25¢
Buffalo	1085	25¢
Chicago	1105	25¢
Cincinnati	1096	20¢
Cleveland	1056	25¢
Columbus	1109	20¢
Denver	1066	20¢
Detroit	1086	25¢
Hartford	1059	20¢
Houston	1084	20¢
Jacksonville	1110	15¢
Kansas City	1064	20¢
Indianapolis	1075	20¢
Los Angeles	1094	25¢
Louisville	1112	20¢
Memphis	1067	15¢
Milwaukee	1099	10¢
Minneapolis-St. Paul	1068	25¢
Newark-Jersey City	1081	25¢
New Orleans	1074	15¢
New York	1101	30¢
Norfolk-Portsmouth	1088	15¢
Oklahoma City	1070	15¢
Philadelphia	1060	25¢
Phoenix	1103	15¢
Pittsburgh	1082	20¢
Providence	1071	20¢
Richmond	1058	15¢
Rochester	1087	20¢
St. Louis	1095	25¢
Salt Lake City	1069	15¢
San Francisco-Oakland	1076	25¢
Scranton	1078	15¢
Seattle	1057	20¢
Trenton	1104	15¢
Worcester	1077	20¢

H. M. Douty
Chief, Division of Wages and Industrial Relations, Bureau of Labor Statistics, Department of Labor

Statistics as a Career

1. The Field of Statistics

Statistics is a branch of scientific method that deals with problems requiring answers in the form of numerical information – that is, information obtained by counting or measuring. Statistical data are collected to provide such information and thus help answer important questions of policy or scientific research. The determination of policies about military manpower or the testing of a physical theory, for example, can best proceed if the right kind of information is obtained. The statistician can help to decide what information is needed, and then supervise its collection, handling, and interpretation. His task is to find out what the data mean.

In trying to find out what the data mean, statisticians have evolved a still broader concept of their field. In most problems in the administration of governmental or business organizations, or in the search for scientific generalizations, complete information cannot be obtained and partial information must be sought and used. The statistician's task is to provide rational principles and techniques that tell when and how judgments can be made on the basis of this partial information, and what partial information is most worth seeking. In short, statistics has come to be regarded, by its practitioners if not by the layman, as a method of making wise decisions in the face of uncertainty.

Statistical methods derive chiefly from the tools of mathematics, and it is quite natural to regard statistics as a branch of applied mathematics. Many of the fundamental advances in statistical method, as opposed to extensions of the applications of the method, can be made only by people of high mathematical attainments. But the real essence of statistical method is imaginative, realistic, logical thinking. Hence many of the applications of statistical methods to practical problems, and indeed many of the basic advances in statistical methodology, are made by people of relatively humble mathematical attainments.

2. Where Statistics Is Applied

The word *statistics* is related to *state* and originally referred to data concerning the State; for example, data about the population, taxes, taxable property, and foreign trade. The earliest statistical applications were concerned with the collection and interpretation of such data. These problems are still with us. The Federal government is perhaps the largest individual employer of statisticians, but there are many other sources of employment for the modern statistician.

The following paper was prepared chiefly by Howard L. Jones of the Illinois Bell Telephone Company and Harry V. Roberts of the University of Chicago at the joint request of the National Office of the American Statistical Association and the Association's Committee on the Training of Statisticians. The objective was a concise statement of the field of statistics and its career opportunities that could be given to young people and others who are considering the possibility of becoming statisticians or applying statistics to substantive fields. Most of the exposition is that of Jones and Roberts and represents their personal views, but they have drawn freely on the work of others who have expressed ideas in a particularly vivid way. Conscious raids were made on writings of L. J. Savage, W. Allen Wallis, S. S. Wilks, and the author of the excellent "Description of the Profession of Statistics" prepared for the National Roster of Scientific and Specialized Personnel. A preliminary draft of this paper was read by W. J. Dixon, Charles A. Glover, Philip J. McCarthy, L. J. Savage, John H. Smith, Rutledge Vining, and S. S. Wilks. Many, though not all, of their helpful suggestions have been incorporated in the final draft.

The gathering of statistics has probably been going on for at least as long as governments have existed. The study of statistical method is much more recent. The scope and promise of statistics was clearly expressed and illustrated by a few writers at the beginning of the nineteenth century, but its principal growth began about fifty years ago, and continues unabated. In this period statistical methods were first applied intensively to a few special fields, notably anthropometry, agronomy, and genetics. The new methods developed in these fields were quickly improved and applied to almost every field of empirical inquiry. Let us glance briefly at a few of these fields.

Statistical methods have been increasingly used by modern business enterprises. The one element common to all problems faced by business executives is the need to make decisions in the face of uncertainty; and the essence of modern statistics lies in the development of general principles of dealing wisely with uncertainty. It is not surprising, then, that statistical methods are widely applicable in nearly all areas of

managerial decision. Applications are made in fields as varied as market research, quality control of manufactured products, selection of personnel, the design of industrial experiments, auditing, and many others as well.

Statistical methods have found increasing application in governmental work. Modern statistical methods, for example, have been used to obtain accurate monthly estimates of employment and unemployment in the United States and to estimate more frequently many other characteristics of the population which had previously been ascertained only at the ten year intervals when a complete enumeration or census is taken. These same sampling methods are used to make available key information from censuses long before the complete tabulations can be made. The demands of war have called forth other applications of statistical methods. Some of the problems investigated statistically by allied governments during World War II included studies of merchant ship losses as a function of convoy size; aircraft losses as a function of time since overhaul; the sampling inspection of items mass-produced by industry; estimation of tire inventories; and estimates of enemy output and capacity.

Investigations in the social sciences have relied increasingly on statistical methods. For example, the sampling survey has economically supplied information on topics as diverse as incomes and savings, attitudes toward the Soviet Union, and the analysis of election results. Insight into problems of individual psychology has been gained by the analysis of psychological tests of many kinds. The increasing use of mathematical models which attempt to explain social behavior has brought an increasing interest in statistical techniques by which the validity of these models can be tested.

The demands of research in the biological sciences brought forth the initial developments of modern statistical methods, and the use of statistical methods in this area has continued to grow. Experiments about the crop yields resulting from different fertilizers and types of soil, or the growth of animals under different diets and environments, are very frequently designed with the aid of statistical principles. The development of genetics as a science has been intimately tied up with the development of the methods of statistics. Statistical methods are also being introduced in research in medicine and public health.

In other fields of research the use of statistical tools is less widespread. In history, linguistics, and the physical sciences, for example, less extensive use of statistical techniques has been made; but even in these fields statistics finds important applications and the number of these applications is increasing.

This listing of statistical applications is not intended to be exhaustive but rather to suggest the diversity of applications of the underlying methods and ideas of statistics.

3. What Statisticians Do

At the present time there are roughly 5,000 people in this country who belong to the American Statistical Association. The Institute of Mathematical Statistics, founded in 1935, now has more than 1,200 members. The American Society for Quality Control, an organization founded in 1946 for fostering the application of statistical methods in industry, now has more than 5,000 members. The Biometric Society, formed in 1947 for promoting the use of mathematical and statistical methods in the biological sciences, has nearly 900 members. Similar organizations for economics and psychology, the Econometric Society and the Psychometric Society, were formed in the early 1930's and now have approximately 1,600 and 350 members respectively. Other societies having varying degrees of interest in the application of statistical methods to their problems are The American Public Health Association, The American Marketing Association, The American Association for Public Opinion Research. Allowing for duplication of membership among these and other societies, we guess that there are between 10,000 and 20,000 people in the United States who belong to organizations in which statistical methods are frequently discussed and written about. On the other hand there are very few people, perhaps 500 to 1,000, who regard themselves as statisticians primarily.

The chief demand for statisticians arises from the contribution of statistics in the solution of problems in one of the fields discussed in Section 2. That is why so many people who use statistics are not primarily statisticians. In this respect, statistics resembles mathematics. A great many people are interested in applying mathematics to practical problems; but there are comparatively few mathematicians in the vocational sense of the word. Similarly, the knowledge of how to speak and write the English language is of interest to most people; but there are few who make this field of knowledge their principal occupation.

Hence we can distinguish two broad classes of statistical workers. The first consists of the mathematical statistician who deals with the mathematical theory that underlies developments in statistical theory. The other class is the applied statistician who concerns himself with the application of statistical methods to one or more fields and who is usually called a biologist, economist, sociologist, or industrial quality control engineer, etc., rather than statistician.

The borderline between "mathematical statistician" and "applied statistician" is not sharp. The mathematical statistician, however, tends to have a greater knowledge of statistical principles and a greater ability to develop new methods to meet new requirements. He can transfer with greater ease from statistical work in one field into statistical work in another field than can the applied statistician, or he may work wholly in statistical theory and come into contact with applied work only by his consultation with other statisticians. The applied statistician, by contrast, tends more to emphasize the subject matter of an applied field. Frequently, applied statisticians have started out in some profession or science without being much interested in statistical methods. But they ran into problems where statistical techniques were acutely needed and then set out to acquire statistical competence.

To convey an idea of what mathematical and applied statisticians do, it may be helpful to consider two specific applications of statistics. Suppose, for example, that a research worker in astronomy takes a series of measurements of some physical magnitude, such as the angular distance between two stars. His measurements will generally not all be exactly alike, but will fluctuate from one measurement to the next. The problem is to decide what measurement, or combination of measurements, to use as the estimate of the true distance.

This type of problem was considered by Gauss and other mathematicians about 150 years ago. They assumed that the observed measurements behave as though each measurement were the sum of two numbers, where one number is the true measurement and the other is a random selection from a hatful of positive and negative numbers that add up to zero.

If this assumption is correct, the best estimate of the true measurement depends on the distribution of the numbers in the hat. Suppose we let M denote the true measurement; e one of the numbers in the hat; and y the measurement actually observed. Also, suppose the distribution of e's is such that the probability of observing a particular measurement is proportional to the normal probability function. Then the best estimate of M is the simple average, or arithmetic mean, of the measurements. For some other kind of distribution, the simple average may not be the best estimate of M. It is known, however, that if each difference, or error, in measuring arises from a large number of independent chance causes, each producing a small positive or negative additive contribution to the total error, then the distribution of the total error will approximate this normal type. Moreover, the simple average may be a good estimate even when the conditions specified here are not completely satisfied. Investigations of the most desirable methods of estimation under various conditions are among the most useful contributions of mathematical statisticians.

Another illustration may help to convey the nature of statistical problems and the modes of attack which are available. A manufacturer makes a very expensive product which can be tested only by destroying the product. It was desired to find out the effect on the final product of changes of six variable components in the manufacturing process. The traditional approach would have been to vary one component at a time and observe the effect on the final product. But it was necessary for each variable to be observed at five different "levels"—for example, a metal alloy in the final product needed to be tried with five different concentrations of one of the ingredients. Hence if five units of the product were to be made up at each of five different levels of one of the variables, twenty-five units of the final product would have to have been tested. But then nothing would be learned about the other five variables. In this particular application, however, a statistician actually worked out an experimental design which permitted the *simultaneous* evaluation of the effect of each of the six variables (each at five levels) on the quality of the final product, and only twenty-five units of the final product had to be tested in total. It was possible to test whether each of which cannot reasonably be attributed to chance or random variations. For those variables which had a significant effect, it was possible to estimate what the effect was, so that the "optimum" level of the variable could henceforth be used in the manufacturing process. In this problem, as in the earlier example, it was of course necessary to make certain assumptions about the physical situation being studied.

4. Qualifications Required of a Statistician

It is always difficult to write of "job qualifications" without becoming involved in a generalized list of virtues which are hardly ever combined in the same individual. Certain qualifications, however, seem to be both important and specific enough to warrant discussion. These may be listed under three general headings:

1. Imagination and insight.
2. Training in techniques.
3. Self-expression.

In what follows, we shall be thinking primarily of the applied statistician. The same general remarks would apply to the mathematical statistician, but the emphasis on "training in techniques" would be relatively greater.

Imagination and insight are put first on our list. The reason for this is that the important practical

problems amenable to statistical attack are almost never stated in mathematical or statistical language. Yet, with sufficient imagination and insight, some of these problems can be so stated; and once stated, many can be solved by existing techniques or techniques which can be devised from the underlying theory of statistics. Let us consider a business illustration.

Suppose you are employed in a business that prepares a forecast of its annual sales at the beginning of each year, and that the forecast for the current year has been broken down by quarters. On April 15, the actual sales for the first quarter of the year become available. They turn out to be a little lower than the forecast, although there appears to be no particular reason for the difference between the actual sales and the first quarter's forecast. These questions now arise. Should the forecast for the rest of the year be revised? If so, how much?

Imagine that you are attending a conference to discuss these questions. Mr. A suggests that the forecast for each remaining quarter of the year be revised by the difference between the actual sales and the forecast for the first quarter. Mr. B recommends that adjustments be made which are based on the proportionate rather than the absolute discrepancy between predicted and actual sales during the first quarter. Mr. C objects to these procedures, since he has observed that the first revision of these forecasts is frequently worse than the original forecasts. He suggests that the original forecast be left unchanged. All three agree that some uniform rule of procedure is needed, since the same problem arises every year and almost every quarter. They turn to you for help. What would you suggest?

This problem, or one very similar, must come up rather often in practically every business organization. It will be stated almost the way it was given in the last paragraph, and not as a mathematical or statistical problem. The statistician needs insight and imagination to abstract the relevant aspects of such problems and then to apply textbook techniques or techniques of his own devising to the solution of the problem.

This brings us to the second desirable qualification: training in techniques. A good mathematical background is very useful, if you can get it. High-school algebra is sufficient background for an introduction to some of the main ideas of statistics; first year college mathematics is almost essential as a background for mastery of standard techniques, and a knowledge of calculus is desirable; to be able to devise techniques which fit problems better than the standard ones, and to invent new techniques, it is desirable to go much further in mathematics. It is desirable to master matrix algebra, including linear transformations; n-dimensional Euclidean geometry; the theory of measure and integration; the Fourier integral; and the theory of complex variables.

The preparation possible in statistics proper is dependent on the student's mathematical background. There are textbooks and courses at each of the levels mentioned above, and the potential statistician should go as far as he can. Perhaps a listing of one good book at each of the levels will be helpful in indicating where the student may obtain further information about the subject matter of statistics. The books listed are not necessarily the "best" and they may not give sufficient attention to the application of statistics in the field of the student's greatest interest; but each book competently describes statistical theory and some of its applications.

Level 1. (A general understanding of important statistical ideas, assuming practically no mathematical preparation): *Statistics,* L. H. C. Tippett, The Home University Library Series, Oxford Press.

Level 2. (Understanding of statistical theory at the level of first year college mathematics): *Introduction to Statistical Analysis,* W. J. Dixon and F. J. Massey, Jr., McGraw-Hill Book Company, Inc., 1951.

Level 3. (Understanding of statistical theory at the level of the calculus): *An Introduction to the Theory of Statistics,* Alexander M. Mood, McGraw-Hill Book Company, Inc., 1950.

Level 4. (Understanding of statistical theory at the advanced mathematical level): *Mathematical Methods of Statistics,* Harald Cramer, Princeton University Press, 1946.

Another important part of training in techniques is familiarity with the subject matter in some applied field, such as economics, psychology, business or physics. Training in a substantive field is essential for all but a few mathematical statisticians. Such training is important not only because a knowledge of the subject matter to which statistics is applied is vital in most applications, but also because statistical theory may best be learned when the student can visualize applications to some substantive field.

The third qualification is self-expression. The statistician is like other technical people in that he must communicate his ideas and findings to the ultimate users, whether these be executives in a business or workers in some scientific field. Facility in oral and written exposition is therefore most desirable.

Another quality which deserves mention is the ability to work well with other people. The statistician is frequently a consultant, co-worker or staff assistant. He must learn to work well with other people, since his skills are seldom of use without the help of others. He must understand as much as he can of

the problems faced by these people if his own advice and assistance are to be of much value.

5. Rewards

There are examples of statisticians who have achieved distinction outside their own specialties, but these are exceptional. In general, technical ability does not pay as well as the ability to direct the work of other people and keep them happy and busy. There are few who have the combination of technical training and executive ability which is often associated with top salaries.

The financial rewards of statistical work are likely to be similar to rewards in other scientific specialties. The academic statistician is likely to be paid about as well as his fellow professors; the business or government statistician, about as well as other scientifically trained workers in the same organization.

Perhaps other compensations should be stressed more than the financial ones. Scientific research is fascinating for many. Statistical training is likely to play an increasing role in scientific work, at least for the next 20 or 30 years. As we have seen, statistical methods are applicable to almost every science as well as most business, eleemosynary, and governmental organizations. The statistician can look forward to participation in many kinds of research. Statistics itself is so new that the student of mathematical statistics can arrive quickly at the limits of existing knowledge. A large proportion of practical applications furnish a challenge to surpass these limits.

Moreover, those whose primary interest lies in other fields — the economists, accountants, biologists, sociologists, engineers, and so on—may find the application of statistical methods necessary in their own fields. Public accountants, for example, habitually verify small samples during the course of an audit, and are coming to realize the importance of statistical principles in selecting these samples and assessing the risks involved. Accountants with more than average mathematical and statistical backgrounds will certainly be assigned some interesting problems.

To summarize, statisticians and other people with a good understanding of statistical principles have excellent prospects of professional achievement and advancement. They may anticipate financial compensation that compares favorably with that of other scientific workers. Their background will serve them well if they eventually go into executive or administrative work. Moreover, for those with aptitudes and training along statistical lines, the problems encountered the highly interesting. Interesting work and the respect of one's fellow workers are perhaps the most important rewards in statistics.

NEWS CONTINUED

Quality Control in Soviet Russia

Soviet Academician I. Artobolevsky, in closing an extended discussion of the level of product inspection in Soviet plants in the trade union newspaper, Trud, of Moscow, proposed steps to bring about the wider adoption of statistical quality control in Russian plants.

Writing with the endorsement of the editors of the official labor newspaper, Artobolevsky said, according to The Current Digest of the Soviet Press:

"The statistical method of inspection, which is being used more and more widely in machine building, has great possibilities. It enables methods of mathematical analysis to be applied in checking the quality of production.

"Unfortunately, other branches of industry where the statistical method of inspection would have considerable effect are lagging in applying it. It is necessary to exchange experience, to call a scientific conference which would engage in a comprehensive discussion of methods of statistical inspection and conditions of its application in enterprises of various branches of the national economy.

"The U.S.S.R. Academy of Sciences, and particularly its Mathematics Institute, is faced with the task of developing methods of mathematical statistics for technical inspection. The branch institutes should also work out their own systems and methods of mathematical inspection."

Bruce Jenkinson, of the Bureau of the Census, died unexpectedly in July, 1952. Mr. Jenkinson was an active member of the Association's Committee on Presentation.

Sidney B. Clark, of the National Production Authority, who worked in Washington as a statistician for a number of years, died suddenly of a heart attack in September, 1952.

Urban Mortgage Loan Statistics in One Life Company

by ELEANOR S. BAGLEY

This is the second in a series of papers on intra company statistics given at the 111th Annual Meeting.

Nonfarm mortgage debt now constitutes over $77 billions or about half of the private long term debt outstanding in the United States. Three-fourths of this total is held by leading financial institutions. Approximately one-quarter is held by the life companies alone. The skill with which mortgage lending operations are managed by life companies is thus important not only to themselves, but also to the stability of our economy. The problems of the thirties were, at very least, accentuated both by the floodtide of nonfarm foreclosures and by the irregular flow of new mortgage money.

As investors, life companies are now keenly aware of the volatility of real estate and mortgage markets, of the long run nature of the risk, of the substantial identity between the best interests of lender and borrower, and of the great importance of regional and local trends in mortgage lending results. Such considerations emphasize the need for a mortgage lending philosophy in which the longer view predominates, integrated with judgments on current competitive markets and current lending organization.

Such an approach also necessitates a system to furnish a continuing variety of statistics over and above purely accounting records. This paper attempts to delineate briefly the system developed in the Mutual Life of New York, and some applications to typical problems faced by the mortgage lending institution.

Establishment of Statistical Records

Mortgage lenders require data on the volume and nature of lending at every stage in the lending operation, beginning with loans submitted for consideration, proceeding through approval or rejection to the final closing. Once loans are held in portfolio, their progress should be followed through to termination, whether by ultimate repayment, sale, or foreclosure.

Two written records are maintained, one established at the time the loan is acquired and not altered afterward, the other a dual purpose accounting ledger card which is serviced regularly. These are designed not only to describe loans acquired and held, but to relate delinquencies, foreclosures, capital losses, and actual yield results to the differential characteristics of the loans which produced them. Because so many statistics are required, random sampling has been used for FHA and VA small home loans, where the Company acquires relatively large numbers of more or less standardized loans. We complete information on all conventional loans, whether residential or commercial, because variations in the size and characteristics of loans in this category make any sampling procedure of doubtful validity.

Sources of data include, among others, credit reports, the borrower's application form, architectural blueprints and engineering surveys, the Company's appraisal forms, legal documents, correspondents' servicing and inspection reports, and economic research analyses. The data have, for convenience, been grouped according to the main elements of mortgage risk as indicated by past experience, defined as borrower, property loan contract, and economic background aspects.

For the borrower, who is recognized to be the first line of defense against loss, we record age; income; occupation; number of dependents; the ratio of mortgage carrying costs to income; and, as a crude way of judging the relation of total property carrying costs to his ability to pay, the ratio of appraised value to income. Somewhat less comprehensive borrower data are obtained for commercial loans which are largely made to real estate corporations set up solely to manage property. In such cases the property's earning power, therefore, tends to be the first, as well as the ultimate, line of defense against loss.

Factors affecting both current and prospective property values are significant because they influence salvage value in the event of foreclosure. Two considerations underline this significance. First, the length of tenure of owner-occupied homes is apparently much shorter than might be expected — perhaps less than ten years. But mortgagees do not invariably know when a property changes hands, and the liability of the original mortgagor is, from a practical standpoint, frequently unenforceable. Therefore, the mortgagee must look to the attractiveness and value of the property as bearing not only on salvage value after default, but as influencing the chance of foreclosure in the first instance. Study of property considerations is also essential because the same risk patterns which produce higher or lower foreclosure ratios do not necessarily affect losses on properties foreclosed in the same degree or even in the same direction.

Property information recorded includes: location; type; appraised value, with the division between land and building (since mortgagees have come to grief through excessive reliance on land values in the past); age; type of occupancy; neighborhood rating; room rent group (for apartments); net property income (both a past average and expectancy); ratio of net income to gross rent.

The characteristics of the mortgage contract itself are recorded, and its interrelationships with borrower and property characteristics.

These include: amount and type of loan; interest rate; term and amortization provisions; payment frequency; and the loan-to-value ratio. Ideally, we would also follow the ratio of the mortgage payment to the probable rental value of the property on owned home loans, as well as to property income on other types. However, the cost of estimating the rental value, which varies widely over time, seemed too high for a large number of small loans.

One final, but by no means least important, element is the economic background rating of the city in which the property is located. These ratings are judgments made on the basis of careful examination of growth and stability of income sources within the city, together with analysis of local real estate and mortgage market conditions. The impact of foreclosure and loss in the past has varied widely from city to city in accord with such trends.

Some Applications of Mortgage Statistics

The mortgage lending officer faces a variety of problems both of longer run investment policy and of a current operating nature.

1. *The Problem of Satisfactory Loan Volume and Quality*

To sustain a going mortgage lending organization, operating at a reasonable unit cost, a fairly even flow of new loans is desirable. An even flow would also avoid concentrating portfolio acquisition all in boom years, in loans highly vulnerable to foreclosure and loss. However, building and mortgage volume is highly cyclical; if loans are to be obtained at all, they must be obtained when the demand for them exists. The best that can be done, therefore, is to secure loans of the highest quality possible, diversifying as much as possible with respect to type, area, and time made. (The estimated yields available in relation to estimated risk and cost are, of course, always a most important consideration which will be discussed more fully below.) A flexible ceiling allotment system devised for our correspondents attempts to achieve these ends and to assure that we are getting our share of the mortgage market in each area. Monthly reports on each correspondent's approvals by loan type measure progress against these ceilings and show whether or not we are achieving balance in our new lending.

A more detailed, but less frequent, check on the quality of our acquisitions, is also planned covering all the mortgage risk elements on which we accumulate information. By comparing this with the preferred risk characteristics shown by such excellent studies of past mortgage experience as the recent National Bureau analysis by R. J. Saulnier, we hope to control and improve the quality of our new loans even further.

2. *Yields on New Mortgage Investments*

The fundamental criterion of overall investment policy for a life company is to maximize the return which it obtains on its total invested funds, net after all costs and losses. To do this it must be able to estimate what the return is likely to be on alternative forms of new investment and determine the most advantageous disposition of its funds among them. Thus the estimated net realized yield on various classes of securities, for example, become a kind of opportunity cost which must be met by the yields on various types of mortgages.

Since both losses and handling costs vary appreciably with the type of mortgage being made, the lending officer must know the quality "mix" of his new loans, as well as the gross yield they return, in order to estimate what net yield is likely to be realized over their life. The approach to such yield estimates which we have devised projects past foreclosure and loss rates, modified on a judgment basis, with allowance for the indicated risk characteristics of the loans we are acquiring currently. Similar estimates are made for securities of different quality ratings and the comparative results are used in the formation of each year's investment program.

3. *Mortgage Reserves*

Mortgage losses can probably be minimized through careful selection and supervision but they cannot be eliminated. Reserves are needed because losses are concentrated in depression years, whereas the income from a mortgage portfolio tends to be highest in prosperous years when new investment is high.

Under present regulations of the State Insurance Departments, life companies are, on the whole, allowed to set up reserves outside the flat surplus limitation to which they are subject only against mortgages on which losses have already developed or appear likely to develop. In other words, they are reserves allocated against loans already known to be impaired. However, now that historical foreclosure and loss experience furnish some reasonable basis for judgment, it should be possible to make some advance

provision for loss by accumulating a portion of income in reserves even before potential losses on specific mortgages become apparent. Reserves of this type were permitted to be set up for securities for the first time at the end of 1951.

Such advance provision for loss should offer significant advantages for the lender, and might at the same time dampen some of the destabilizing effect which mortgage lending operations seem to have had on the economy in years past. Once reserves have been established, investment policy should no longer be hampered by the continual fear of impairing surplus position. During the last depression it seems probable that the need to maintain surplus resulted in the disposal of good mortgages by some institutions, leaving those of poorer quality in the portfolio. The same fear of incurring additional risk at a time when losses already were eating into surplus may have prevented the making of some very good mortgages which were available at the bottom of the depression.

Another desirable result which might be expected to flow from the lender's greater psychological security would be increased willingness to work out trouble situations with borrowers on a flexible basis, and thus to ward off some foreclosures together with the disruptive effects these have on the general economic situation.

We have been experimenting with possible approaches to this type of mortgage reserve. Of course, the estimation in advance of probable losses rests on two broad assumptions: (1) the belief that past experience has some applicability to the future, and (2) the belief that the portfolio consists of a sufficient number of roughly homogeneous individual investments, so that the standard error of a loss rate derived from a larger universe will not be so greatly increased as to make its application meaningless. In practice, we realize that both of these assumptions are far from being fulfilled. Today's mortgage product is quite different from that of the early thirties. Therefore, we have modified the rates we would apply in accord with judgment based on present conditions. We appreciate also that the loss rates used for accumulating reserves on large commercial loans will be subject to a wide margin of error because there are so few loans in similar risk categories, and they vary so widely in size.

Nevertheless we feel that this kind of reserve approach would represent a great improvement over present practice for the reasons I mentioned above. Obviously it cannot be utilized without adequate statistical analysis both of loans being acquired and of changes in the quality of the portfolio over time. Such reserve systems would require constant checking in the light of subsequent developments, for with such long term instruments as mortgages, far-reaching changes in quality can occur which cannot conceivably be foreseen at the time the loans are originally placed on the books.

4. *Portfolio Supervision*

Data on the changing status of loans already held in portfolio are, of course, also turned to good account in the continuing problems of portfolio supervision. Changes in quality are checked in two ways: first, through direct measurement of the changes — for example, through tabulating changing appraised values and borrower characteristics if the property changes hands — and, second, indirectly, through following such symptoms as delinquency and repayment reports. In addition, the mortgage officer will want coordinate reports on the adequacy of supervision of the portfolio by his field organization, covering particularly the frequency and results of property inspections.

Such information enables the lender to anticipate and prepare for future trouble in any locality. It also provides data required to formulate an intelligent program for disposing of mortgages no longer desired in the portfolio.

5. *Improvement of Lending Standards*

In addition to these regular operating needs for information on both the flow of new loans and on the portfolio, the life insurance lender is always seeking to improve its basic lending standards by improving its fundamental knowledge about the nature and results of mortgage risk. In view of the considerable number of variables which appear to influence mortgage results, it is, of course, unlikely that any one institution can rely too heavily on its own experience, since it will not be based on a sufficiently large sample to justify statistical generalization. However, it is definitely to the lender's long-run advantage to maintain records which will facilitate a contribution to such pooling of experience as the excellent National Bureau* study of the lending results of 20 large life companies to which I referred before. Such combined studies could probably continue to be made on an ad hoc basis without maintaining continuing records, but an attempt to handle them in this fashion results in a loss of valuable information since records on terminated loans, which are actually the crux of such studies, will have been destroyed in whole or in part.

Furthermore, continuing study of its own experience enables the individual investor to interpret and

*This study ("Urban Mortgage Lending by Life Insurance Companies," R. J. Saulnier, 1950) is probably the definitive analysis in this field. Other analyses cover smaller samples, shorter or earlier periods, or do not carry beyond foreclosure to loss experience.

utilize to greater advantage the broader findings of combined experience studies. The combined studies are almost necessarily purely factual—i.e., they indicate that loans on one kind of property, to one type of borrower produced better or poorer results in the past, but they throw little light on the why of these better or poorer results. And yet, the investing institution seeking to apply these historical findings to its own problems of investment policy is very much interested in the "why," for the very reason that past history can never be projected mechanically into the future, particularly for as long a period as the 20-30 years entailed in present mortgage lending operations. In applying historical data, the institution must always judge whether or not underlying trends have changed sufficiently to warrant a reasonable expectation that the results of the past will be modified in the future.

Detailed analysis of the behavior of your own loans is most helpful in forming such judgments. For example, most experience studies show that experience on amortized mortages has been far superior to that on loans which do not call for regular repayment. Since most mortgages made today are amortized, it would be easy to jump to the comforting conclusion that they are all "Grade A" in quality. And yet, even abstracting from other changes in the situation, our own analyses of the repayment record of amortized mortgages indicates that such provisions may have produced better results chiefly because they indicated a different attitude toward the loan by the borrower, rather than because of anything inherent in the mechanics of debt repayment. Obviously, once all loans are amortized, as a matter of custom, amortization has lost its function as a barometer of the borrower's attitude.

CHANGES IN THE CONSTITUTION

Letters to the Secretary

August 19, 1952

Dear Sir:

In answer to your request in the June-July issue of *The American Statistician* for comments on the proposed new Constitution and By-Laws, I wish to point out a minor detail which may already have been called to your attention by others.

In the By-Laws, Article III, Section 1, the restrictive clause, "other than that regarding ratification of an amendment to the Constitution," does not seem to be necessitated by anything in Article XIII of the new Constitution. If the purpose is to leave the voting open for a longer period in that case, it would be more effective to name a specific period.

Very truly yours,
THOMAS A. ELKINS

September 9, 1952

Dear Mr. Weiss:

I submit the following comments on the draft of the revised Constitution in the June-July issue of The American Statistician:

1. I am puzzled by the failure to recognize or define Sections in the Constitution, though they are mentioned in the By-Laws. (II, Par. 6 and VII, Par. 2) Duties and status are assigned to Section Committees as such rather than as the executive agencies of large groups of members. This treatment seems to me both illogical and a reversal of previous Association actions and point of view.

2. I do not understand why the Commission on Statistical Standards and Organization is omitted. This Commission was established by vote of the Association and its importance recognized in discussion at the December, 1951 Council meeting. Difficulties in activating the Commission do not justify dropping all reference to it.

I do not regard this draft of the Constitution as merely "a correction of obvious deficiencies of a non controversial nature." I suggest that the Committee on the Constitution be requested to prepare an alternative draft incorporating reference to Sections and the Commission on Statistical Standards and Organization consistent with A.S.A. votes and approved Section Charters.

Yours sincerely,
ROBERT W. BURGESS

September 19, 1952

Dear Mr. Weiss:

Upon looking over the text of the new Constitution which appeared in the June-July issue of *The American Statistician,* I was struck by the fact that the Constitution does not make any provision for the election of members of our Association to act as representatives of other societies.

I trust that some arrangement can be made to correct this omission before the Constitution is ratified by the membership.

Sincerely yours,
BEN LIPSTEIN

Recent Changes in Statistics Courses and Curricula in Western Universities

by WILLIAM A. SPURR
Stanford University

The area covered by this report includes the twelve states from Montana, Wyoming, Colorado, New Mexico, and Texas to the Pacific coast. This vast territory is the most recently settled part of the nation and has grown most rapidly in recent years. The statistics curricula in its universities, too, have been established only recently for the most part but have developed rather remarkably over the past five or ten years.

I will discuss mathematical statistics first, followed by applied statistics in the fields of busines and economics, psychology and education, public health, medicine and biology, and other disciplines.

I have attempted to cover all of the larger universities in the West, but could not include all those of moderate size, so many important developments may have been overlooked. Any suggestions from this group to fill these gaps will be appreciated.

Mathematical Statistics

Perhaps the outstanding development of statistics teaching in the West has been the establishment of programs in mathematical statistics, particularly at the University of California, Stanford, and the University of Washington. The first two appear to compare favorably in size with any others in the country except for North Carolina. Prior to the formation of these departments only a few basic courses in mathematical statistics were offered, but now they comprise substantial staffs offering a score or more of courses in each case leading to statistics degrees at all three major levels. These departments also offer research and consulting services, in both theoretical and applied fields, which have proved of substantial value to government and private industry.

The Statistical Laboratory of the University of California at Berkeley was established in 1938 and now boasts seven or eight faculty members of professorial rank and about the same number of instructors. Over twenty courses are offered, some extending as long as four semesters, covering all the major fields of mathematical statistics, but with particular stress on statistical inference, probability, and testing of hypotheses. Applications of statistics to quality control, astronomy, public health, and population are also taught. The laboratory offers a mathematical type M.A. degree and a Ph.D. with either mathematical or applied emphasis. The staff publishes the numerous "Statistics Series" through the University Press.

The Stanford Statistics Department was established only in 1947 but is already comparable in course offerings and size of faculty (if visiting professors are included) with the Berkeley Laboratory. The Stanford curriculum stresses statistical decision theory, the theory of games, sampling problems, and applications in quality control and acceptance inspection. One interesting sequence of courses covers mathematics for statisticians and social scientists. All these offerings are of recent origin. The department offers A.B., M.S., and Ph.D. degrees in statistics as separate from mathematics. A substantial research program is carried on for the Office of Naval Research.

The Laboratory of Statistical Research at the University of Washington was established still more recently, in 1948. Nevertheless, this laboratory already includes three faculty members of professorial rank and various junior members and research assistants. Over a dozen courses are offered, including a two-quarter sequence in biometrics, and degrees are offered in mathematical statistics at the A.B., M.S., and Ph.D. levels. Contract research is also carried on for the Office of Naval Research.

The University of Oregon offers a variety of statistics courses in its mathematics department, which serve students in anthropology, psychology, sociology, economics and education, as well as mathematics. There seems to be more centralization in statistics offerings within the mathematics department here than in the other universities surveyed. The department offers all three degrees with permissible concentration in mathematical statistics.

The University of California at Los Angeles has introduced new courses in probability, theory of testing hypotheses and estimation, multivariate analysis, and stochastic process, with greater emphasis on graduate work than formerly. The M.A. and Ph.D. degrees may be earned with work divided equally between mathematics and statistics.

The other universities surveyed have only one man at the most teaching statistics in the mathematics department, with only a few basic course offerings such as "mathematical statistics," probability and sampling in each case.

Of the universities described above, Stanford is the

This is one of a group of papers given at the 111th Annual Meeting, which dealt with recent developments in the teaching of statistics.

only one with a statistics department separate from mathematics. The laboratory at Berkeley is quasi-independent and has its own budget. Washington has its own laboratory within the mathematics department, but the statistics courses elsewhere are not distinguished from other courses offered by the mathematics departments.

Despite the rapid growth of mathematical statistics curricula, there appears to be little or no tendency toward concentrating the teaching of applied statistics in the mathematics department, except at the University of Oregon. The typical argument for decentralization is that the teaching of statistics is so closely related to the subject matter of the department that it cannot be separated.

It is my opinion that mathematical statistics can be developed most effectively if it has departmental status separate from mathematics. This arrangement will increase its prestige and independence, and will facilitate the development of new courses and research programs without restrictions from the senior mathematicians, as well as stimulating consulting service and liaison with the applied departments.

Business and Economic Statistics

Business and Economics are considered together, since in the majority of universities surveyed the same statistics courses serve both departments. This field was better developed ten years ago than was mathematical statistics, so its recent progress has been less spectacular. Nevertheless, nearly all of the universities surveyed have expanded their business and economic statistics offerings in recent years and some, such as Southern Methodist and Washington, have added this subject as a new field of specialization.

The Southern Methodist Department of Statistics was established in 1941 as a part of the new School of Business Administration. A staff of six now offers a dozen courses in such fields as graphic statistics, quality control, business indices, forecasting, industry analysis, and statistics in business research. A statistics major is offered toward the B.B.A. degree and a major and minor toward the M.B.A. degree.

The University of Washington has expended its offerings from ten to twenty-four hours, including new courses in sampling and correlation. The recently recognized major in business statistics may be applied toward either the M.B.A. or D.C.S. degree.

The Universities of Denver and Texas were already well developed in business and economic statistics before the war — in fact, more so than the statistics offerings in any other department — so that recent changes have been less marked. Texas, for example, has six men devoting most of their time to business statistics, and offers a business statistics major toward the B.B.A., M.B.A. and Ph.D. degrees.

Colorado has expanded its offerings in regional statistics, time series, and forecasting. A statistics minor is now offered toward the M.S., M.A. and Ph.D. degrees in business, and the new degree of Master of Personnel Service requires considerable statistics.

California has added two advanced courses in economic statistics at both the Berkeley and Los Angeles campuses. The latter has also expanded its probability, sampling, and correlation analysis in business, and offers the M.A. and Ph.D. degrees in Economics with a minor in statistics.

Oregon, too, has added courses in correlation and research methods.

A new eight-unit program is being developed at Southern California, including a course in personnel and labor statistics. At Stanford new courses have been offered in business research methods in the Graduate School of Business and in quantitative analysis, theory of games, and time series analysis in the Economics Department.

Yet the subject which has expanded most rapidly in recent years has been *quality control,* which is taught more commonly in engineering schools than in schools of business. At least one course in this subject has been added to the curriculum of nearly every university surveyed. The subject appears to be best developed at Stanford where four courses are offered in qaulity control, sampling inspection, and sequential analysis in the industrial engineering and statistics departments. The University of Colorado College of Engineering has also added three new courses in quality control and industrial statistics.

Western universities generally offer more statistics courses in schools of business and economics departments than in any other departments. Most of them now offer statistics as a major or minor toward all their degrees, but the subject is always subordinated to the general field of business or economics itself. This condition has not changed much in recent years.

The administrative dichotomy also continues unchanged, whereby the same statistics courses serve both the economics and business departments in some universities but are strictly segregated in others.

Psychology and Education

Statistics courses in psychology, education, and educational psychology are considered together since in many universities the offerings of these departments are combined. As in the case of business and economics, there is no evident tendency toward either centralization or separation of statistical courses in these departments.

Statistical courses in psychology and education have expanded substantially in recent years. Factor analysis, analysis of variance, and testing methods have been increasingly stressed. The University of Washington,

for example, has added courses in factor analysis, testing, matrix methods, proficiency evaluation and occupational analysis. A Psychological Testing Laboratory has been established under the Division of Counseling and Testing. A Public Opinion Laboratory has also been set up under the Sociology Department, in cooperation with Washington State College. This department requires 36 quarter hours toward the M.A. and 60 hours toward the Ph.D. Its offerings include such psychology courses as public opinion analysis and tests and measurements, as well as sociology courses in sampling, experimentation and sociological research methods.

The University of Utah now offers an undergraduate minor in statistics under the Educational Psychology Department, as well as a Ph.D. minor in the Psychology Department. Six new courses have been added in these fields, including psychological measurement theory and factor analysis.

Colorado has added three new courses in factor analysis, sampling and analysis of variance respectively. Oregon has also inaugurated three courses in psychometrics and psychological measurements in education. Southern California has added courses in psychological measurement and the mathematical treatment of psychological data, with stiff mathematical prerequisites.

The curricula in other universities, such as California and Stanford, were already well developed ten years ago and show no radical changes.

Public Health, Medicine and Biology

There have been several noteworthy developments in the teaching of public health statistics during recent years. U.C.L.A., for example, has a new statistics curriculum in the Department of Public Health consisting of five courses in biometry, applied biostatistics and related subjects. The University of Washington Public Health and Preventive Medicine Department has also established a B.S. degree in public health statistics, toward which courses in biostatistics, statistical methods in biological assay and similar subjects may be applied. The Colorado School of Medicine, too, has added a course in biostatistics.

In the field of biology proper, statistics appears to be best developed in its applications to forestry. The University of Montana, for example, offers six courses in forest mensuration and research methods in forestry, while Washington has added two courses in forest mensuration to its forestry currimulum.

Other Fields

In addition to the applied fields already discussed, statistics teaching has expanded during recent years in departments of sociology, public administration, physics and philosophy. Utah, Colorado and U.C.L.A. have added elementary courses in social statistics, but this field is perhaps better developed in smaller colleges where such courses serve all the social sciences. Southern California now offers a course in Statistics for Public Administration.

In the field of physics, Utah has established courses in Principles of Physical Statistics and Statistical Mechanics, while Denver and Stanford have each added one course in this field. The lengthening beam of statistical reasoning has even appeared in a philosophy department, with a course in Chance and Prediction at the University of Colorado.

Conclusion

The outstanding development of statistical teaching in the West during recent years has probably been in the growth of semi-independent programs in mathematical statistics. At the same time the primary emphasis in statistics training remains in the many applied fields, with little or no tendency toward consolidation in this respect. At the present time, the volume of statistics course offerings is greatest in business and economics curricula, second greatest in mathematics departments and third in psychology and education.

Statistics curricula in the major fields of mathematics, business, economics, psychology, and education are generally offered as a field of concentration toward one or more degrees. Course offerings have been expanded in nearly all universities, particularly in such fields as statistical inference, sampling, quality control, factor analysis and other techniques stressed in the literature of recent years. Few, if any, courses have been discarded. Several universities, however, were omitted from this report in deference to local pride since their statistics offerings are still nominal in all fields.

There is little uniformity in the statistics curricula of Western universities beyond the elementary level. The mathematical prerequisites, too, vary from nil to advanced calculus. Statistics teaching is expanding rapidly in the West, but in a rather helter-skelter fashion.

The rapid growth of statistical courses in such heterogeneous directions suggests the need of some recommended standards prepared by a competent professional agency. It is strongly urged that the training section of the American Statistical Association consider setting up a recommended curriculum of general and applied statistics both for the typical larger university and the smaller school, as well as minimum standards of competence for the professional statistician. Other professional groups, such as accountants, engineers, lawyers and doctors, have long since established minimum and uniform standards for training and professional achievement. Statistics is now of age. It is high time we did the same.

112th Annual Meeting of the AMERICAN STATISTICAL ASSOCIATION

December 27 - 30, 1952, Palmer House, Chicago, Illinois

In addition to the program given here, there will be a special exhibit which is being arranged with the following theme: "How the Social Sciences can use the latest equipment to do a more effective job."

SATURDAY, DECEMBER 27, 1952

Morning — **Credibility in Life Insurance**
Chairman: Mortimer Spiegelman, Metropolitan Life Insurance Company

Papers — Credibility Procedures Are Required To Estimate Parameter Values for Individuals of Heterogeneous Populations
A. L. Bailey, Lumbermens Mutual Casualty Company of Chicago

Discussion — J. E. Freund, Alfred University
John W. Tukey, Princeton University

Morning — **Quality Control**
Committee on Statistics in the Physical Sciences
Joint with: Mid-West Regional Group—A.S.Q.C.
Chairman: W. R. Pabst, Jr., Department of the Navy

Papers — Place of Quality Control in a Statistical Program for Industry
W. E. Deming, Bureau of the Budget

Discussion — Fred J. Halton, Deere & Co.,
Ray S. Saddoris

Morning — **Federal Sponsorship of Data Collecting Activities by Non-Governmental Agencies**
Business and Economic Statistics Section
Chairman: Thomas J. Mills, Bureau of the Budget

Papers — Scope and Nature of the Federal Program
Harry Alpert, Bureau of the Budget
Problems of Data Collection Under Federal Sponsorship
(a) By the Universities
Speaker to be announced
(b) By Private Survey Agencies
Sam Barton, Market Research Corp. of America

Discussion — Everett Ashley, Housing and Home Finance Agency

Noon Luncheon — **Economic Forecasts**
Business and Economic Statistics Section
Chairman: Martin Gainsbrugh, National Industrial Conference Board
Speakers: Frederick V. Waugh, Bureau of Agricultural Economics
Charles E. Young, Weyerhaeuser Timber Co.
Theodore Yntema, Ford Motor Company

Afternoon — **Symposium: Recent Developments in the Use of Probability Sampling in Agricultural Economics and Statistics**
Joint with: American Farm Economic Association
Chairman: Arnold J. King, National Analysts, Inc.

Papers — Objective Sampling of California Grape and Peach Crops
George Kuznets, University of California
George Harvey, Federal State Crop Reporting Service
Use of Probability Sampling In Turkish Census of Agriculture, Manufacturing and Business
Charles F. Sarle, National Anlysts, Inc., and
Vincent Lidquist, Mutual Security Agency, Ankara, Turkey
Combining Probability Sampling and Experimental Design in Marketing Research
Walter T. Federer, Cornell University

Afternoon — **Statistical Analysis of Biological Time Series**
Biometrics Section
Joint with: Biometric Society—E.N.A.R.
Chairman: B. G. Greenberg, University of North Carolina

Papers — The Problem of Autoregression in Regression Analysis
R. L. Anderson, North Carolina State College
The Use of Observations Taken Periodically in Growth Studies
H. L. Lucas, North Carolina State College
The Statistical Analysis of Biological Time Series
A. M. Dutton, University of Rochester

Discussion — Informal

Afternoon

New Developments in the Use of Sample Surveys To Determine Health Conditions
Committee on Statistics in the Social Sciences
Joint with: American Public Health Association; Biometric Society

Papers

Household Survey
Chairman: Paul M. Densen, University of Pittsburgh
Neva R. Deardorff, Health Insurance Plan of Greater New York, and
Jerome Cornfield, National Institutes of Health
The Use of Census Current Population Survey To Obtain Information on Morbidity
Theodore D. Woolsey, Federal Security Agency
The Association Between Health and Social Problems in the Population
Paul M. Densen and Antonio Ciocco and Daniel Horvitz, University of Pittsburgh

Afternoon

Application of Statistics To Astronomy
Committee on Statistics in the Physical Sciences
Chairman: Walter Bartky, University of Chicago

Papers

Distribution of Extragalactic Nebulae
S. Chandrasekhar, University of Chicago
Theory of Clustering of Galaxies in a Static and in an Expanding Universe
J. Neyman and E. L. Scott, University of California
(Title to be Announced)
Bengt Strömgren, Yerkes Observatory

Discussion

John W. Tukey, Princeton University
Harold Hotelling, University of North Carolina

Afternoon

Quality Control
Committee on Statistics in the Physical Sciences
Joint with: Mid-West Regional Group—A.S.Q.C.
Chairman: Lloyd Knowler, Iowa State University

Papers

Some Examples of Effectiveness of a Quality Control Chart
Leo A. Aroian, Hughes Aircraft
Design of Control Charts for Current Use with a Given Standard
Acheson J. Duncan, Johns Hopkins University
Quality Index Control Charts
Bonnie B. Small, Western Electric Company

Discussion

Besse B. Day, Department of the Navy
W. R. Pabst, Jr., Department of the Navy

Afternoon

Practical Uses of Transportation Flow Data
Business and Economic Statistics Section
Joint with: American Economic Association
Chairman: E. G. Plowman, U. S. Steel Corporation

Papers

Technical Aspects of Transportation Flow Data
R. Tynes Smith, III, Interstate Commerce Commission
Utilization of Transportation Flow Data by Carriers
E. S. Root, Erie Railroad Company
Utilization of Transportation Flow Data by the Department of Defense and Other Shippers
D. M. Steiner, Department of Defense

Discussion

W. Edwards Deming, Bureau of the Budget
C. Austin Sutherland, National Tank Truck Carriers, Inc.
Ray S. Kelley, Jr.

Afternoon

Economic Forecasts and Their Accuracy
Joint with: American Economic Association
Chairman: Arthur R. Upgren, University of Minnesota

Papers

A Survey of Recent Economic Forecasts
Rutledge Vining, University of Virginia, and
Gerhard Colm, National Planning Association
Forecasts of the War Production Authorities
Robinson Newcombe, Office of Defense Mobilization, and
Joseph Mehan, Department of Commerce, and
George Jaszi, Department of Commerce

Discussion

Geoffrey Moore, National Bureau of Economic Research
Lewis Bassie, University of Illinois
T. V. Kreps, Stanford University

Afternoon

Mathematical Biology
Biometrics Section
Chairman: Professor Rashevsky

Papers

A Mathematical Theory of Capillary Exchange as a Function of Tissue Structure
G. W. Schmidt
Mathematical Biophysics of the Cardio-Vascular System
George Karreman
Probabalistic Theory of Neural and Social Processes
Anatol Rapoport

Afternoon	**Coordination of Social Statistics at the Federal Level** *Committee on Statistics in the Social Sciences* *Chairman:* Harry Alpert, Bureau of the Budget
Papers	Building a Coordinated National System of Vital Statistics Halbert Dunn, National Office of Vital Statistics Coordination of Population Estimates Used by Federal, State and Local Agencies Henry S. Shryock, Jr., Bureau of the Census Coordination of Population and Manpower Statistical Studies Seymour Wolfbein, Bureau of Labor Statistics
Discussion	Donald C. Riley, Bureau of the Budget
Afternoon	**Meaning and Measurement of Capacity** *Business and Economic Statistics Section* *Chairman:* Alvin Mayne, Defense Production Administration
Papers	Concepts of Capacity Raymond T. Bowman, University of Pennsylvania A New Approach To the Capacity Measurement Samuel Weiss, and Seymour Wolfbein, Bureau of Labor Statistics
Discussion	Stephen P. Taylor, Department of Commerce Robert N. Grosse, Bureau of the Budget
Evening	**Feature Session** (Speakers to be Announced)

SUNDAY, DECEMBER 28, 1952

Morning	**Section on the Training of Statisticians**—Breakfast Business Meeting **Business and Economic Statistics Section**—Business Meeting
Noon	**Round Table on Activities of Committee on Statistics in the Physical Sciences** **Business Meeting of Outgoing Board of Directors**
Afternoon	**1952 Census Tract Conference** *Committee on Census Enumeration Areas* *Joint with: American Marketing Association* *Chairman:* Howard Whipple Green, Cleveland Health Council
Papers	Current Developments and Problems in Connection with the Census Tract Program Roy V. Peel, Director of the Census Census Tract and Urban Research Donald L. Foley, University of Rochester Index of Socio-Economic Status by Census Tracts W. Thurber Fales, Baltimore City Health Department Putting Census Tracts To Work in Local Communities IN CHICAGO Leo Shapiro, Toni Company IN OTHER CITIES Three 5-minute presentations with maps and charts. Each participant will show how census tracts are being put to work in his community. General Discussion
Afternoon	**Federal Estimates of National Savings** *Business and Economic Statistics Section* *Chairman:* Stuart A. Rice
Papers	What an Economist Wants in the Way of Savings Data Gerhard Colm, National Planning Association Needed Improvements in Federal Statistics Avram Kisselgoff, Bank of New York
Discussion	Peter Henle, American Federation of Labor Raymond Goldsmith Eugene Zorn, American Bankers Association Tibor Scitovsky, Stanford University, or V. Lewis Bassie, University of Illinois
Afternoon	**Demonstration and Experiment in the Teaching of Elementary Statistics** *Section on the Training of Statisticians* *Chairman:* Philip J. McCarthy, Cornell University
Papers	The Use of Laboratory Experiments in the Teaching of Probability Statistics A. C. Rosander, George Washington University
Discussion	W. J. Dixon, University of Oregon Edwin G. Olds, Carnegie Institue of Technology

Afternoon — **Application of Statistics To Earth Sciences—A**
Committee on Statistics in the Physical Sciences
Chairman: Edward S. Deevey, Jr.
Geochronometric Laboratory, New Haven, Connecticut

Papers
Application of Statistical Methods To Sedimentary Data
W. H. Krumbein, Northwestern University
Some Statistical Problems in Field Geology
Howard J. Pincus, Ohio State University

Discussion
I. W. Burr, Purdue University
K. A. Brownlee, University of Chicago

Afternoon — **Experimental Design**
Biometrics Section and Committee on Statistics in the Physical Sciences
Joint with: Biometric Society—E.N.A.R.
Chairman: Cuthbert Daniel

Papers
Linked Blocks
W. J. Youden, National Bureau of Standards
Multiple Comparisons
John Tukey, Princeton University

Afternoon — **The Role of Mathematics in the Social Sciences**
Joint with: American Association for the Advancement of Science—Section K
Chairman: Simon Kuznets, University of Pennsylvania

Papers
The Potential Contributions of Mathematics to Economic and Social Statistics
Frederick F. Stephan, Princeton University
Limits of Mathematics in Statistics
Wladimir S. Woytinsky, The Johns Hopkins University

Discussion
David Rosenblatt, Washington, D. C.
Dorothy Brady, Bureau of Labor Statistics
Jacob Marschak, Cowles Commission

Afternoon — **New Electronic Machines and the Future of Statistics**
Chairman: Emil Schell, Department of the Air Force

Papers
C. C. Hurd, International Business Machines
H. L. Mitchell, Eckert Mauchly Division, Remington Rand

Afternoon — **Use of Statistics in Hospital Planning**
Committee on Statistics in the Social Sciences
Joint with: American Hospital Association
Chairman: Paul M. Densen, University of Pittsburgh

Papers
Statistical Aspects of Hospital Accreditation
E. L. Crosby, Johns Hopkins Hospital
Statistical Problems Encountered in the Work of the Commission on Financing of Hospital Care
Isidore Altman, Commission on Financing Hospital Care

Afternoon — **The New Consumers Price Index**
Business and Economic Statistics Section
Joint with: Econometric Society
Chairman: Bruce Mudgett, University of Minnesota

Papers
The New Consumers Price Index
Edward Hollander, Bureau of Labor Statistics

Discussion
Lazare Tepper, International Ladies Garment Workers Union
Laura Mae Webb, Bureau of the Budget
Robert A. Sayre, Bureau of Railway Economics, Association of American Railroads

Afternoon — **Labor Force and Employment Trends and Projections: 1900-2000**
Business and Economic Statistics Section
Joint with: American Economic Association
Chairman: Charles D. Stewart, Bureau of Labor Statistics

Papers
Estimates of Labor Force, Employment and Unemployment, 1900-1950
Stanley Lebergott, Bureau of the Budget
Projections of Labor Force and Employment; 1950-2000
Calman Winegarden, Bureau of Labor Statistics

Discussion
John Durand, United Nations Population Office
David Kaplan, Bureau of the Census
Gladys Palmer, University of Pennsylvania

Afternoon — **Application of Statistics To Earth Sciences—B**
Committee on Statistics in the Physical Sciences
Chairman: Edward S. Deevey, Jr., Geochronometric Laboratory, New Haven, Connecticut

Papers
Ocean Wave and Analysis of Their Appearance, Propagation and Properties in Terms of Time Series, Power, Spectra and Statistics
Willard J. Pierson, Jr., New York University
Climatology's Needs in Statistical Research
Arnold Court, University of California

Discussion
K. A. Brownlee, University of Chicago
I. W. Burr, Purdue University

Afternoon	**Determining Optimum Conditions** *Biometrics Section and Committee on Statistics in the Physical Sciences* *Joint with: Biometric Society—E.N.A.R.* *Chairman:* Harold Hotelling, University of North Carolina
Papers	Recent Advances in Finding Best Operating Conditions R. L. Anderson, University of North Carolina Some Problems in Determining Maxima of Functions of Several Variables Frederick Mosteller, Harvard University
Afternoon	**Local Statistics—The Philadelphia Story** *Chairman:* Leonard A. Drake, Chamber of Commerce of Greater Philadelphia
Papers	City and Area Statistics—Chamber of Commerce Experience Leonard A. Drake Buying Habits of Philadelphia Families: An Example of Student Research Myron Heidingsfield, Temple University Development, Analysis and Use Made of Local Statistics by a City Planning Commission Harlin G. Loomer, City Planning Commission of Philadelphia
Afternoon	**For All Members—American Statistical Association Business Meeting**
Evening	**American Statstical Association Presidential Address** Aryness Joy Wickens, President, American Statistical Association
	Following Presidential Address a reception for all members

MONDAY, DECEMBER 29, 1952

Morning	**Breakfast—Chapter Secretaries and District Representatives Meeting**
	Reliability and Usability of Soviet Statistics *Chairman:* Stuart A. Rice, Bureau of the Budget Introduction: The Issues Formulated. (By the Chairman)
Papers	The Soviet Statistical System: A Preliminary Examination Harry Schwartz Syracuse University and New York Times Conceptions of Socio-Economic Data Incorporated in Soviet Classification Systems Vladimir S. Kolesnikoff, Bureau of the Budget The Reliability and Usability of Population and Vital Statistics Frank Lorimer, American University The Reliability and Usability of Soviet Agricultural Statistics Lazar Volin, Department of Agriculture The Reliability and Usability of Soviet National Income Statistics Alexander Gerschenkron, Harvard University Summary Appraisal Abram Bergson, Columbia University
Morning	**Randomization Theory of Experimental Inference** *Biometrics Section* *Joint with: Biometric Society—E.N.A.R.* *Chairman:* A. M. Mood, RAND Corporation, Santa Monica, California
Papers	Randomization Theory of Experimental Inference O. Kempthorne, Iowa State College
Discussion	W. G. Cochran, Johns Hopkins University
Morning	**Use of Statistical Techniques In Evaluating the Effectiveness of Counseling Services** *Committee on Statistics in the Social Sciences* *Joint with: Social Work Research Group* *Chairman:* Edwin W. Davis, University of Illinois
Papers	Measuring Effectiveness of Psychotherapy Carl Rogers, University of Chicago Evaluating Counseling in Social Work Charles P. Gershenson, Jewish Children's Bureau Establishing Diagnostic Categories for Counseling Types Harold B. Pepinsky, Ohio State University Measuring of Unconscious Attitudes Fred Fiedler, University of Illinois
Morning	**Application of Statistics To Chemical Engineering** *Committee on Statistics in the Physical Sciences* *Chairman:* J. C. Whitwell, Princeton University
Papers	Factorial Design Applied To a Specific Chemical Development Problem H. Grohskopf, American Cyanamid Company F. Wilcoxon Physical Properties of Wool Fibers Dependence Upon Fiber Diameter and Grade T. F. Evans, Textile Research Institute
Discussion	Cuthbert Daniel K. A. Brownlee, University of Chicago

Morning

The Meaning of Statistics Classified by Industry
Business and Economic Statistics Section
Chairman: Walter F. Ryan, Bureau of the Budget

Papers

The Elements of an Industrial Classification System
Walt R. Simmons, Bureau of Labor Statistics
Reporting of Information by Establishment: Theory and Practice
Maxwell R. Conklin, Bureau of the Census
William H. Cummins, Bureau of Old-Age and Survivors Insurance

Discussion

Leonard A. Drake, Chamber of Commerce of Greater Philadelphia
Hyman Bookbinder, Amalgamated Clothing Workers of America
Tillman Sogge, St. Olaf College

Morning

Applications of Non-Parametric Methods
Biometrics Section
Joint with: Biometric Society—E.N.A.R.
Chairman: John W. Tukey, Princeton University

Papers

General Review of Non-Parametric Methods, with Special Emphasis on Randomized Tests
Lincoln E. Moses, Stanford University
Rank Analysis in the Estimation of Threshold Values
M. E. Terry, Bell Telephone Laboratories
Power of Non-Parametric Tests for Normal Alternatives
W. J. Dixon, University of Oregon

Discussion

A. M. Mood, RAND Corporation
W. H. Kruskal, University of Chicago
D. R. Whitney, Ohio State University

Morning

Recent Developments In Occupational Mobility Research
Committee on Statistics in the Social Sciences
Chairman: Gladys L. Palmer, University of Pennsylvania

Papers

Research Design of the Survey of Patterns and Factors in Mobility in Six Cities
Margaret Gordon, University of California
A Technique for Analyzing the Influence of One or More Factors on Difference in Crude Mobility Rates
Evelyn M. Kitagawa, University of Chicago
Techniques for Analysis of Verticle Mobility
Albert J. Reiss, Jr., Vanderbilt University
Research Design for Studies of the Mobility of Workers in Critical Occupations
Harold Goldstein, Bureau of Labor Statistics
The Application of Mobility Research To Labor Supply Models
Robert Steffes, Bureau of the Budget

Morning

Elementary Statistics Courses In Relation To New Developments and Theory
Section on the Training of Statisticians
Chairman: Rutledge Vining, University of Virginia

Papers

Non-Parametric Methods in the Elementary Statistics Course
Ralph Bradley, Virginia Polytechnic Institute
Decision Theory in the Elementary Statistics Course
J. Kiefer, Cornell University

Discussion

Max A. Woodbury, University of Pennsylvania

Morning

Application of Statistics To Chemistry
Committee on Statistics in the Physical Sciences
Chairman: W. J. Youden, Bureau of Standards

Papers

Carbon-14 in Dating
W. F. Libby, University of Chicago
Philosophy of Experimentation
G. E. Kimball, Columbia University

Discussion

G. E. Albert, University of Tennessee
R. L. Anderson, University of North Carolina

Noon Luncheon

The Stock Market
Business and Economic Statistics Section
Chairman: J. Parker Hall, Investment Analysts Society of Chicago

Papers

Railroads—Their Future, and Place
Pierre R. Bretey, Baker Weeks & Harden
New Industries
Jeremy C. Jenks
Cyrus J. Lawrence
The Trend for 1953
Richard W. Lambourne, Dodge & Cox

Discussion

M. Dutton Morehouse

Noon Luncheon

Incoming Council and Board of Directors Meeting
Biometrics Section—Business Luncheon

Afternoon — **The Statistics of Industrial Relations**
Joint with: Industrial Relations Research Association
Chairman: Nelson M. Bortz, Railroad and Airlines Wage Board

Papers
Concentration of Trade Union Membership
Leo Wolman, National Bureau of Economic Research
Scope and Extent of Collective Bargaining
Kirk R. Petchek, Bureau of Labor Statistics

Discussion
Philip Taft, Brown University
Albert S. Epstein, International Association of Machinists

Afternoon — **Response Errors in Enumerative Surveys**
Committee on Statistics in the Social Sciences
Chairman: Rensis Likert, University of Michigan

Papers
Current Experience and Research Findings
Presented by: Ely Marks, Bureau of the Census
Herbert Hyman, National Opinion Research Center
Lester Frankel, Alfred Politz, Inc.
Leslie Kish, Survey Research Center

Afternoon — **Problems and Activities of Experiment Station Statisticians**
Biometrics Section
Joint with: Biometric Society—E.N.A.R.
Chairman: H. W. Norton, University of Illinois

Papers
Organizational and Statistical Problems Facing the Neophyte Station Statistician
J. G. Darroch, Washington State College
Organization and Scope of Activities of Station Statisticians
C. E. Marshall, Oklahoma A & M

Discussion
Henry Tucker, Kansas State College
V. L. Anderson, Purdue University
P. G. Homeyer, Iowa State College
R. J. Monroe, North Carolina State College

Afternoon — **Statistics for Small Business**
Business and Economic Statistics Section
Chairman: Alvin Mayne, National Production Authority

Papers
Problems of Small Business in a Mobilization Economy
Representative, Small Defense Plants Administration
Employment Trends Among Small Businesses Since Korea
Seymour Wolfbein, Bureau of Labor Statistics

Discussion
A. D. H. Kaplan, Brookings Institution
A. J. Jaffe, Columbia University
Representative, Senate Committee on Small Business

Afternoon — **Application of Statistics To Physics**
Committee on Statistics in the Physical Sciences
Chairman: W. E. Deming, Bureau of the Budget

Papers
Precision Measurements in Thermometry
H. F. Stimson, Bureau of Standards
Comparison of Standard Meter Bars
W. J. Youden, Bureau of Standards
Churchill Eisenhart, Bureau of Standards

Discussion
Edgar P. King, Bureau of Standards
David Votaw, Yale University

Afternoon — **Determination of Means and Regression Coefficients**
Biometrics Section and Committee on Statistics in the Physical Sciences
Joint with: Biometric Society—E.N.A.R.
Chairman: Forman S. Acton, Forrestal Research Center, Princeton University

Papers
Comparison of the Means of Two Samples
David Wallace, Princeton, New Jersey
Exposition of Straight Line Fitting Methods
Richard F. Link, Princeton, New Jersey

Afternoon — **The Distribution of Government Burdens and Benefits**
Business and Economic Statistics Section
Joint with: American Economic Association
Chairman: Simeon E. Leland, Northwestern University

Papers
Distribution of Government Burdens and Benefits by Income Classes
Rufus S. Tucker, General Motors Corporation
General Equilibrium Aspects of Incidence Theory
Richard A. Musgrave, University of Michigan

Discussion
Earl R. Rolph, Bureau of Economic Research
Harold M. Groves, University of Wisconsin
Richard B. Goode, International Monetary Fund

Afternoon — **The New Development in Vital Statistics**
Committee on Statistics in the Social Sciences
Chairman: Halbert L. Dunn, Office of Vital Statistics

Papers
Production of Vital Statistics as a Combined Federal-State Operation
O. K. Sagen, State Department of Public Health, Illinois
Broadening the Significance of Vital Statistics Through Special Studies
Paul M. Densen, University of Pittsburgh
Improving Marriage and Divorce Statistics
Hugh Carter, Office of Vital Statistics

Discussion	Howard West, Office of Vital Statistics Sam Shapiro, Office of Vital Statistics Paul C. Glick, Bureau of the Census
Evening	**Recent Applications of Statistical Methods In Various Countries**
	Chairman: Stuart Rice, International Statistical Institute
Papers	Developments in the Field of Agriculture, Distribution, Income, and Production Herbert Marshall, Canada
	International Comparisons of National Income G. Findlay Shirras, Great Britain
	Other Speakers to be announced
Evening	**What Is Actuarial Soundness In A Pension Plan?**
	Business and Economic Statistics Section
	Joint with: American Economic Assn., Industrial Relations Research Assn., Association of University Teachers of Insurance
	Chairman: Henry W. Steinhaus, Equitable Life of New York
Papers	The Concept of Actuarial Soundness Dorrance C. Bronson, Wyatt Company
	Actuarial Soundness in Group Annuity Plans Ray M. Peterson, Equitable Life Assurance Society
	Actuarial Soundness in Trusteed and Governmental Retirement Plans George B. Buck
	Legal Implications of Actuarial Soundness Edwin S. Cohen, Hatch, Root, Barrett, Cohen and Knapp
	Labor's View of Actuarial Requirements in Pension Plan Solomon Barkin, Textile Workers, C.I.O.

TUESDAY, DECEMBER 30, 1952

Morning	**Analysis of 1952 Election Polls**
	(Speaker to be announced)
Morning	**Statistical Techniques in Management**
	Business and Economic Statistics Section
	Chairman: Holbrook Working, Stanford University
Papers	Management's Awakening to the Value of Statistics E. H. MacNiece, Johnson & Johnson
	(To be announced) Robert K. Mueller, Plastics Division, Monsanto Chemical Company
	Statistical Techniques as a National Resource W. Edwards Deming, Bureau of the Budget and New York University
Morning	**Sampling Inspection In Public Assistance**
	Committee on Statistics in the Social Sciences
	Joint with: Social Work Research Group
	Chairman: David G. French, University of Michigan
Papers	Applicability of Sampling Inspection Techniques in Testing the Quality of the Job of the Public Assistance Visitor Walter M. Perkins, Social Security Administration
Discussion	Myer Dwass, Northwestern University John Kidneigh, University of Minnesota William E. Gordon, George Warren Brown School of Social Work Willis M. Oosterhof, State Department of Public Welfare, Michigan
Morning	**Application of Statistics In Engineering**
	Committee on Statistics in the Physical Sciences
	Chairman: Boyd Harshbarger, Virginia Polytechnic Institute
Papers	Some Applications of Statistics To Time and Motion Research Hale C. Sweeny, Virginia Polytechnic Institute
	Industrial Applications of Methods of Weighted Working Errors To Regression Problems in Which the Dependent Variables is Dichotomous Raymond C. Rhodes, Hercules Powder Company
Discussion	I. W. Burr, Purdue University John W. Tukey, Princeton University
Morning	**Graphic Correlation**
	Business and Economic Statistics Section
	Chairman: Albert Neisser, Treasury Dept.
Papers	Applications of the Central Principle in Graphic Correlation Louis H. Bean, Department of Agriculture
	Mathematical Bases for the Method of Graphic Correlation Richard J. Foote, Bureau of Agricultural Economics, Department of Agriculture
	Coaxial Graphic Correlation Analysis M. A. Kohler, Weather Bureau
	Graphical Discriminant Function Analysis W. B. Brier, Weather Bureau
Noon Luncheon	**Committee on Statistics in the Social Sciences**—Business Meeting

Philippine Statistical Association

On December 12, 1951, the Philippine Statistical Association was organized in Manila, Republic of the Philippines, with a founding membership of nineteen professional statisticians. On March 1, 1952 the charter membership of the new association numbered seventy-three individuals and, as of May 15, fourteen institutional members, and the Association had a treasury balance of 5000 pesos, approximately $2500.

The objectives of the association are stated in the Preamble of its Constitution, as follows:

> The objectives of the Philippine Statistical Association shall be to foster in the broadest manner statistics and its applications, to promote unity and effectiveness of effort among all concerned with statistical problems, and to increase the contribution of statistics to human welfare. To this end, the Association proposes to conduct meetings; to produce publications devoted to statistical methodology and its applications; to make available information concerning statistical science and its contributions; to stimulate research and promote high professional standards; and, in general, to make statistics of service to other sciences and to practical affairs.

The establishment of this new national organization was the outgrowth of a preliminary meeting on December 8, 1951, at which time the urgent need for a professional society to be concerned with the development and applications of statistics was emphasized. Attendance at the preliminary meeting included ten members of the American Statistical Association in Manila.[1]

Cesar M. Lorenzo, chief statistician of the Department of Economic Research of the Central Bank of the Philippines, was chosen President of the Association; at present on assignment within the Bank as acting director of the Department of Exchange Control, Mr. Lorenzo is a graduate of the University of the Philippines who has spent three years in graduate study in statistics at American University in Washington, D. C. He was a statistician and economist for the Food and Agriculture Organization of the United Nations (1947-49). Exequiel S. Sevilla, first vice president, is general manager and actuary of the National Life Insurance Company (Manila); a *summa cum laude* graduate of the University of the Philippines, he received his M.A. in actuarial science at the University of Michigan. Manuel Ma. Aycardo, M.D., second vice president, a gradaute of the medical school of the University of the Philippines, is chief of the division of epidemiology of the Bureau of Health. The secretary-treasurer is Manuel O. Hizon, Ph.D. (Michigan), actuary and manager of the production department of the Government Services Insurance System of the Philippines, a University of the Philippines *cum laude* graduate in engineering and a member of the American Institute of Mathematical Statistics, Sigma Xi and Phi Beta Kappa (Michigan).

Members of the Board of Directors include Enrique Virata, Ph.D. (Johns Hopkins), vice president of the University of the Philippines; Vicente Mills, former offcial of the US Philippine War Damage Commission (1947-1950), technical consultant in the Office of the U.S. High Commissioner (1946) and Assistant Census Commissioner (1937-41); Rosendo Regalado, labor statistician and chief of the division of statistics and general information of the Bureau of the Census and Statistics, Department of Commerce and Industry; Leon Ma. Gonzales, Ph.D. (Santo Tomas, Manila) of the Office of Economic Coordination and recent director of the Bureau of the Census and Statistics; and Bernardino A. Perez, B.S. University of the Philippines and New York University, former graduate student in mathematics at Harvard, who is now chief of the economics and statistics section, Wage Administration Service, Department of Labor.

Trinidad J. Jaramillo, Ph.D. (Chicago), a member of the original board of directors, formerly assistant director of the Bureau of the Census and Statistics, and recently actuary of the Philippine American Life Insurance Company, has left the Philippines to accept a position with the Armour Research Foundation in Chicago. His place on the board has been taken by Mr. Perez.

The initial membership of the new association is widely representative of the professional interests of statisticians in the Philippines, including the applied fields of psychology, vital statistics, public health, biometrics, economics, labor and manpower, social insurance, actuarial science, market analysis, business administration, college and university teaching. Institutional members of the association, which include banks, insurance companies, manufacturing establishments, and a university, are interested in the application of statistics in their fields of activity and in the promotion of better data in these fields.

At the outset the association has concerned itself with the urgent need for improved civil service

[1] These were Dr. Manuel Ma. Aycardo, Dr. Leon Ma. Gonzales, Dr. Manuel O. Hizon, Dr. Trinidad J. Jaramillo, Mr. Cesar M. Lorenzo, Mr. Ezequiel S. Sevilla, Mr. Vicente Mills, Dr. Enrique Virata, Mr. William I. Abraham, and Dr. Meredith B. Givens. Mr. Abraham was engaged as national income adviser to the Philippine Government under the United Nations Technical Assistance Program, and Dr. Givens has been serving as Smith-Mundt technical advisor on manpower and labor statistics.

standards for statistical positions and with the need for coordination and improvement of the statistical activities of government agencies. The group has sponsored a proposal for the establishment of a Statistical Advisory Board in the Executive Office of the President to survey the statistical services of the government, to establish statistical standards, and to guide the planning and development of the services.

Committees of the Association are those on membership, program, statistical standards, personnel and training, publications, and public relations. A publication to be known as the *Philippine Statistician* will be issued.

The Association has initiated a series of lectures at various universities in Manila. The first of the series, a talk on "Statistical Organization for Administration and Planning" was delivered by Dr. Meredith B. Givens on February 19, at the University of the East. The second lecture, on "National Income: Its Meaning and Uses," was given by Mr. William I. Abraham at the auditorium of the Institute of Hygiene, University of the Philippines.

FEDERAL STATISTICAL NEWS CONTINUED

Publication of 17th Decennial Census Reports

In connection with the 1950 Census of Agriculture, Population, and Housing, the following final volumes will be published by approximately the dates indicated. Separate bulletins will also be available, as indicated, for most subjects. More detailed information on contents, prices, etc., may be obtained from the Bureau of the Census, Washington 25, D. C.

AGRICULTURE

Volume I—State Reports with Agriculture Statistics for Counties and State Economic Areas. Issued in 34 parts, each comprising several States and Territories and possessions; all parts will have been published by the end of October 1952.

Volume II—Agriculture Statistics by Subjects for States, Geographic Divisions, and for the United States. To be published by the end of December 1951, with individual chapters also available as separate bulletins.

Volume III—Irrigation of Agricultural Lands. To be published by December 1952, with reports for selected States also available as separate bulletins.

Volume IV—Drainage of Agricultural Lands. To be available by December 1952.

POPULATION

Volume I—Number of Inhabitants. Separate chapters for each State have been published (Series P-A Bulletins); the United States summary and the Territories and possessions bulletins are at the printer. The volume in bound form will be available in December 1952.

Volume II—General Characteristics of the Population. A separate part including three chapters will be published for each State; each chapter will be issued initially as a preprint bulletin: Series P-A, Number of Inhabitants (see Vol. I above); Series P-B, General Characteristics (all to be available by December 1952); Series P-C, Detailed Characteristics (to be issued from November 1952 through March 1953).

Volume III—Census Tract Bulletins. 64 bulletins designated as Series P-D, all to be issued by December 1952; not to be bound together.

HOUSING

Volume I—General Characteristics of Housing. Separate parts for each State are being published (Series H-A). The bound volume will be available by January 1953.

Volume II—Nonfarm Housing Analytical Reports. Separate bulletins (Series H-B) for each standard metropolitan area of 100,000 inhabitants or more and for the United States and the 9 census divisions, all to be issued by early 1953. Bound volume will be available by May 1953.

Volume III—Farm Housing Analytical Report. Publication expected by January 1953.

Volume IV—Residential Housing. To be published in January 1953.

Volume V—Housing Statistics by Blocks. Separate bulletins (Series H-E) for each city of 50,000 inhabitants or more in 1940. All bulletins will have been issued by October 1952; not to be bound together.

OTHER REPORTS AND MONOGRAPHS

Within the limits of available resources, a series of special reports and monographs are planned to follow the reports listed above. To be written by experts in each field, the monographs will present detailed analyses of selected subjects.

Manpower Occupations Card File

Under the sponsorship of the Task Force on Resources and Requirements of the Office of Defense Mobilization Committee on Specialized Personnel, the Bureau of the Census is establishing a duplicate file of approximately 6,000,000 punch cards from the 1950 Census of Population. These cards, which are designated as the Manpower Occupations Card File, will cover workers in all occupations in the two major groups, "Professional, technical and kindred workers" and "Craftsmen, foremen and kindred workers," as well as in a number of other selected occupations. With a few minor exceptions, the duplicate file will consist of all cards for occupations with fewer than 100,000 workers, and 20 percent of the cards for occupations with more than 100,000 workers. Among the subjects included on the punch cards are sex, age, marital status, citizenship, educational attainment, industry, class of worker and income.

One of the major purposes of this file is to make more readily available, for use in studies of the characteristics of workers in particular occupations, information which is not included in the regular tabulation and publication programs for the 1950 Census of Population. Since the cards will be filed by occupation, there will be eliminated the relatively great cost and time factors involved in selecting the cards for a particular occupation from the regular Population Census file of 150,000,000 cards, which is not kept in occupation order. In addition, the file will provide a much larger sample than the 3-1/3 percent sample to be used in many of the 1950 Census tabulations of occupational data. This latter feature will be of particular significance in connection with relatively small but highly important occupational fields, such as the several branches of natural science and engineering.

When the file is completed by the end of the year, it will be available for use in providing tabulations of data as requested by any interested Government agency or any nongovernmental organization having an appropriate need for the information. Arrangements for obtaining such tabulations will be made directly with the Bureau of the Census, and the cost of making the tabulations will be borne by the requesting agency. A list of the occupations included in the file as well as a sample copy of the punch card may be obtained by writing to the Population and Housing Division, Bureau of the Census, Washington 25, D. C.

BERNARD B. WATSON
Professional and Scientific Personnel Specialist, Defense Manpower Administration, Department of Labor

QUESTIONS and ANSWERS

Edited by W. S. CONNOR
I. R. SAVAGE

AN ALTERNATIVE t STATISTIC

Question 33: Let $x_1, x_2, \ldots, x_n$ be n independent observations from a normal distribution with mean μ and variance σ^2. To test the hypothesis that $\mu = \mu_o$ against one-sided or two-sided alternatives when σ is unknown, the statistic which usually is used is Student's t, i.e.,

$$t = \sqrt{n}\,(\bar{x} - \mu_o)/s, \tag{1}$$

where $\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$ and $s^2 = \frac{1}{(n-1)}\sum_{i=1}^{n}(x_i - \bar{x})^2$.

However, a test based on the statistic

$$t_1 = \sqrt{n}\,(\bar{x} - \mu_o)/s_1, \tag{2}$$

where $s_1^2 = \frac{1}{n}\sum_{i=1}^{n}(x_i - \mu_o)^2$, could also be used. Is there any reason why t is preferable to t_1?

Answer: To be specific, let us say that we are testing the null hypothesis H_o: $\mu = \mu_o$ against the alternative hypothesis, H_1: $\mu \neq \mu_o$. The usual test is that based upon the t statistic. We choose some level of significance, say α, and define a critical region such that the probability that an observed t will fall in this region when H_o is true is α. The usual choice is $|t| > t(\alpha)$, where $t(\alpha)$ is the value such that the probability that t will exceed it is $\alpha/2$. If the observed t falls in the critical region, we reject H_o; otherwise, we accept H_o.

We note that t_1 is related to t as follows:

$$t_1^2 = n(\bar{x} - \mu_o)^2 \left[\frac{1}{n}\sum_{i=1}^{n}(x_i - \mu_o)^2\right]^{-1}$$

$$= n(\bar{x} - \mu_o)^2 \left[\frac{1}{n}\sum_{i=1}^{n}(\bar{x}_i - \bar{x})^2 + (\bar{x} - \mu_o)^2\right]^{-1}$$

$$= n[\,(n-1)/t^2 + 1]^{-1},$$

or

$$t_1 = \pm n^{\frac{1}{2}}\,[(n-1)/t^2 + 1]^{\frac{1}{2}}. \tag{3}$$

Because the signs of both t and t_1 are determined by the sign of $(\bar{x} - \mu_o)$, they have the same sign, and hence by (3), t_1 is an increasing function of t. This means that there exists a value $t_1(\alpha)$ such that the probability that $|t_1| > t_1(\alpha)$ is α when H_o is true, and $|t| > t(\alpha)$ if and only if $|t_1| > t_1(\alpha)$. Thus, the probability of rejecting the null hypothesis is the same no matter which statistic is used. In other words, the power (probability of rejecting the null hypothesis when it is false) is the same for both tests. Under this criterion for comparing tests, we conclude that tests based on t and t_1 are identical. However, from a practical point of view, t is more desirable than t_1, since the probability distribution of t is well tabulated.

C. Derman

RANDOMIZED BLOCKS VERSUS BALANCED INCOMPLETE BLOCKS

Question 34: In planning an experiment, the planner is faced with the question of what design to use. If he has v varieties and $vr = n$ plots, he could replicate each variety r times. One possible design is the randomized block design (r.b.d.), in which the experimental area is first divided into r blocks of v plots each, and then every treatment is assigned at random to one of the plots within each block. However, if v is large, one might use a balanced incomplete block design (b.i.b.d.), which has the following properties. There are b blocks of $k < v$ plots each, $bk = n$, and every two treatments occur together in λ different blocks. No treatment occurs more than once in a block. What factors should be considered in choosing between these two designs?

Answer: The object of an experiment is to make comparisons among the treatments, and to demonstrate differences among them if they exist. Thus, one should choose the design which will make the more precise comparisons. The variance of the difference between two treatment estimates is a measure of precision. To make this specific, let σ_1^2 and σ_2^2 be the variances, respectively, of the r.b.d. and the b.i.b.d. Then, the variance of the difference between two treatment estimates is $2\sigma_1^2/r$ for the r.b.d., and σ_2^2/rE for the b.i.b.d., where $E = v/kr$. Since $E < 1$, the latter variance exceeds the former if $\sigma_1 = \sigma_2$. The ratio E is called the "efficiency factor", because it shows how efficient the b.i.b.d. is with respect to the r.b.d.

If $\sigma_1 = \sigma_2$, one would choose the r.b.d. However, it is usually expected that $\sigma_2 < \sigma_1$, because of the smaller block size, and hence the greater uniformity within the block of the b.i.b.d.

Another consideration is the difference in the number of degrees of freedom for error between the two designs. The r.b.d. has $v(r-1) - r + 1$ degrees of freedom for error, as compared with $v(r-1) - vr/k + 1$ degrees of freedom for error in the b.i.b.d. Thus, for a given level of significance, the critical values of t and F are larger (in absolute value) for the b.i.b.d. than for the r.b.d.

Our conclusion is that if σ_2 is enough less than σ_1 to offset both the loss in efficiency and the loss in the degrees of freedom for error, we would choose the b.i.b.d., and otherwise, the r.b.d. An exact answer, which takes into account both the reduction in the variance, and the loss in degrees of freedom, can be obtained by consideration of the power functions of the several tests.

BUS WAITING

Question 35: Users of public transportation often complain that while waiting for a bus to go downtown, an unexpectedly large number of buses go by in the uptown direction. Of course, these complaints are also made by people on the other side of the street, who are waiting for a bus to go uptown. If one assumes some "reasonable" statistical behavior for the buses, is there a basis for these complaints?

J. Q. P.

NEWS about MEMBERS

A **Kenneth J. Arnold,** formerly of the University of Wisconsin, has accepted a position as Associate Professor of Mathematics at Michigan State College.

B **Edward W. Barankin,** Assistant Professor at the Statistical Laboratory, University of California, Berkeley, has been promoted to Associate Professor, effective July 1st, 1952. For the academic year 1952-53, Dr. Barankin will be on leave, working at the Institute for Numerical Analysis, Los Angeles.

Z. W. Birnbaum, formerly of the Department of Statistics at Stanford University, is now with the Department of Mathematics at the University of Washington in Seattle.

Solomon Bochner, Professor at Princeton University, accepted a visiting professorship at the Statistical Laboratory, University of California, Berkeley, for the spring semester of 1952-53.

Robert G. Bowles has left the Arco Paint Co. to work at the experimental station of the B. F. Goodrich Chemical Co. at Avon Lake, Ohio.

C **William E. Coffman,** formerly of Oklahoma A. & M. College, is now with the Personnel Department of Educational Testing Service at Princeton, New Jersey.

Edwin L. Crosby, formerly Director of the Johns Hopkins Hospital, is now Executive Director of the Joint Commission on the Accreditation of Hospitals in Chicago.

D **Leland E. Dake,** formerly Director of Sales Research and Promotion for the Continental Can Company, Inc., is associated with Cresap, McCormick & Paget, New York City.

Louis I. Dublin, Second Vice-President and Statistician of the Metropolitan Life Insurance Company, having reached retirement age, will retire in accordance with the company's plan, at the end of 1952.

Charles W. Dunnett has been granted a leave of absence as Biometrician for the Food and Drug Divisions of the Department of National Health and Welfare at Ottawa, Canada, to join the Department of Mathematics at Cornell University for the academic year 1952-3.

F **Milburn L. Forth** has left the Territorial Information Department of the Commonwealth Edison Company and is now Industrial Economist and Secretary to the Industrial Development Council of The Urban Land Institute in Washington, D. C.

Edward T. Frankel, formerly Budget Analyst with the Health and Welfare Federation of Allegheny County, Pennsylvania, is now a Regional Research Analyst with the Bureau of Public Assistance of the Federal Security Agency in New York.

G **John Gurland,** formerly with the Cowles Commission and the Committee on Statistics at the University of Chicago has joined the staff of the Statistical Laboratory at Iowa State College in Ames.

H **Kenneth Harwood,** active in the field of radio and television research has been made head of the University of Alabama, Department of Radio, with the rank of full professor at the age of 28. Dr. Harwood is the youngest department head in the university.

Y. J. Hayasaki is now working in social welfare service and is a specialist member of the Welfare Statistics Committee of the Ministry of Welfare in Japan.

Marvin Hoffenberg has taken a leave of absence from the Bureau of Labor Statistics to spend some time working with The Rand Corporation in Santa Monica.

Robert G. Hoffman, formerly of the Department of Biostatistics at the School of Public Health at the University of North Carolina, is now at the School of Public Health at the University of Michigan.

Robert Hooke is now associated with the Analytical Research Group and the Statistical Research Group at Princeton, New Jersey.

Harry M. Hughes, Instructor at the Statistical Laboratory, University of California, Berkeley, has been promoted to Assistant Professor, effective July 1, 1952.

J **Paul H. Jacobson** has secured the Ph. D. degree from Columbia University and has returned to his position in the Statistical Bureau of the Metropolitan Life Insurance Company.

Terry A. Jeeves of the Statistical Laboratory, University of California, Berkeley, obtained the Ph.D. degree on a thesis *"Identifiability and Almost-sure Estimability of Linear Structures in n-Dimensions,"* June, 1952.

Everett H. Johnson has been promoted from Associate Professor to Professor of Statistics at the George Washington University.

Norman Lloyd Johnson of University College, London will be engaged in teaching and research in the Department of Mathematical Statistics of the University of North Carolina for the year 1952-1953.

Robert E. Johnson was among 188 American businessmen honored by Charles Sawyer, Secretary of Commerce on March 12, 1952, for services contributed without compensation in the Defense effort. Mr. Johnson, Assistant Chief Economist and Actuary of the Western Electric Co., was loaned to the Government to assist in the establishment of the Materials Control System. Mr. Johnson is also conducting a Statistical Course in the Graduate School of Stevens Institute of Technology and serving as Consultant to the Office of Civilian Requirements in the National Production Authority and The Operations Research Office of John Hopkins University.

K **William C. King** is teaching statistics in the Department of Accounting and Statistics at the University of Missouri.

L **Lucien M. LeCam** of the Statistical Laboratory, University of California, Berkeley, obtained the Ph.D. degree on a thesis, *"On Some Asymptotic Properties of Maximum Likelihood Estimates and Related Bayes' Estimates,"* June, 1952.

Werner Leimbacher, of Zurich, Switzerland, accepted an appointment as Instructor at the Statistical Laboratory, University of California, Berkeley, for the academic year 1952-53.

Edward A. Lew, Associate Actuary of the Metropolitan Life Insurance Company will assume the position of Associate Actuary and Statistician upon the retirement of Dr. Louis I. Dublin of the Metropolitan Life Insurance Company.

M **Douglas G. Marshall,** formerly of the Division of Rural Sociology at University Farm, St. Paul, Minnesota, is now the Department of Rural Sociology at the University of Wisconsin, where he will be doing population research.

William B. Michael, formerly of the Rand Corporation, is now with the Test Bureau of the University of Southern California at Los Angeles.

O. B. Moan, formerly with Julius Hyman & Co. in Denver, Colorado, is now working with International Business Machines in Chicago.

Bruce D. Mudgett is now Emeritus Professor of Economics and Statistics and has left Minneapolis to live in Thetford, Vermont.

O **Bernard Ostle,** formerly of the Statistical Laboratory at Iowa State College, has accepted a position as Associate Professor of Mathematics at Montana State College.

P **Robert F. Pearse** has been appointed Director of the Executive Selection and Development Department of the Harold F. Howard Company, industrial and management engineering consultants in Detroit.

Richard Pearson has accepted a position with the Educational Testing Service at Princeton, New Jersey.

S **Franklin E. Satterthwaite** has joined the Operations Research Group of Arthur D. Little, Inc.

Harold P. Scheinkopf has been appointed manager of the James Thomas Chirung Company, an advertising agency.

NEWS about MEMBERS CONTINUED

Mortimer Spiegelman, now Assistant Statistician at the Metropolitan Life Insurance Company, will be appointed Associate Statistician on the retirement of Dr. Louis I. Dublin, effective January 1, 1953.

Robert G. D. Steel, formerly with the College of Agriculture, Biometry and Physics Section at the University of Wisconsin, is now with the Department of Plant Breeding at Cornell University.

Robert F. Tate of the Statistical Laboratory, University of California, Berkeley, obtained the Ph.D. degree on a thesis, *"Contributions of the Theory of Random Numbers on Random Variables,"* June, 1952.

Benjamin J. Tepping has taken a one year's leave of absence from the U. S. Bureau of the Census to work with the Survey Research Center at the University of Michigan.

Willard L. Thorp, Assistant Secretary of State for Economic Affairs, has been appointed Director of the new Merrill School of Economics of Amherst College. Dr. Thorp will undertake his new duties in the fall of 1952 and will spend the summer months in the Merrill School of Southampton, L. I., and one semester each year at Amherst, as professor of Economics.

Mason E. Wescott, Editor of *Industrial Quality Control* and formerly Professor of Mathematics at Northwestern University, has been appointed Professor of Applied Statistics on the faculty of Rutgers University College.

Chester Arthur Williams, Jr., formerly with the School of Business Administration of the University of Buffalo, is now with the School of Business Administration at the University of Minnesota.

Lowell A. Woodbury is working with the Atomic Bomb Casualty Commission at Hiroshima, Japan, as Senior Biostatistician. The work involves the supervision of the analysis of the data collected by the Commission in connection with studies of the medical effects of the atomic bomb, both at Hiroshima and Nagasaki.

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF **The American Statistician,** published 5 times a year at Washington, D. C., for October, 1952.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, American Statistical Association, 1108 16th Street, N.W., Washington, D. C.; Editor, Sylvia Castleton Weyl, 1108 16th Street, N.W., Washington, D. C.; Managing editor, none; Business manager, none.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.) American Statistical Association, 1108 16th Street, N.W., Washington, D. C.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

SYLVIA WEYL, Editor.

Sworn to and subscribed before me this 19th day of September, 1952.

MARY P. WINDSOR, Notary Public.

(My commission expires April 14, 1951.)

CHAPTER NOTES

HAWAII

The Hawaii Chapter has started a Newsletter which not only carries items of local news interest but also prints brief technical articles. The first issue carried a "Memorandum on Frequency Curve of Profits per Ton of Plantations" by Joel Cox. The second issue carried "Population Projections for Honolulu and Hawaii" by Robert C. Schmitt.

DENVER

The May Meeting of the Denver Chapter was the annual business meeting and the following officers were elected for the 1952-53 season:

President, Franz Huber, Regional Economist, Office of Price Stabilization; *Vice-President,* Lucy Klein, Labor Market Analyst, Colorado Department of Employment Security; *Secretary-Treasurer,* Roland A. Mandat, Actuarial Clerk, Coates, Herfurth & England.

WASHINGTON

The following are the new officers of the Washington Statistical Society: *President,* Emmett Welch; *Vice-President,* Homer Jones; *Secretary-Treasurer,* Margaret Martin.